IMPLICATIONS OF THE REVOLUTION IN MILITARY AFFAIRS (RMA) ON CHINA'S MILITARY MODERNIZATION

DR. PAUL A. TORELLI

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Preface

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This report documents the results as of the above date of a research project carried out by the author while at the National War College during the academic year 1998-1999 It is an assessment of the future military threat posed by the Chinese People's Liberation Army (PLA) to the US and its allies in the Pacific In addition to examining the traditional dimensions of military capability, this report specifically addresses the implications of the Revolution in Military Affairs (RMA) on this assessment The following points pertain to the scope and approach of this report

- This report is intended to inform the debate over whether China poses a strategic threat to the US and its allies in the Asia-Pacific region That is whether and in what ways China's military future military *capability* might alter the balance of power in that region It does not address whether China *intends* to alter the balance of power or the liklihood of a conflict involving the US and China.
- This report addresses only conventional military capability Nuclear, chemical, and biological warfare capability are not addressed The report also does not address the possible use by China of "asymmetric strategies" such as sponsoring terrorism or broad based use of information warfare against the US or its allies This limitation is partly due to time constraints and a complete assessment needs to address these topics However this limitation also reflects the author's perception that these other dimensions of military capability have strategic significance for a great power only in conjunction with conventional forces
- The report is based on unclassified sources A possible classified annex is planned
- The time frame of the assessment is the next ten-to-twenty years.
- Chapter IV, which addresses the RMA and its implications, is based on a combination of published and unpublished work and the author's analysis The remainder of the report is based on published work No interviews have (yet) been conducted solely for this report

Table of Contents

Chapter I Introduction

The relationship between the United States (US) and the Peoples Republic of China (PRC) is regarded by many as the single most important bilateral relationship over the next few decades in terms of long term impact on global security China's real Gross Domestic Product (GDP) has grown at an average rate of 9% per year from 1978 -- when a program of economic reforms was announced -- to 1992 [1] From 1992 to 1996 it has grown at a rate greater than 10% per year (although it has fallen below that level in the past two years). If economic growth continues even at slightly lower rates than these, China will become the world's largest economy between 2010 and 2020 [2] This economic growth by itself makes China an important regional power. Two factors that add to the importance and difficulty of Sino - American relations are China's program of military modernization during the 1990's and Chinese behavior that is characterized by both cooperation and confrontation [3]

These factors have fed a debate on the nature of future Sino-American relations and the policy implications of this evolving relationship On one side, the "China Threat" thesis states that as China, in aggregate economic terms, catches up and surpasses the US, it will become both an adversary and military peer at least in the Asia-Pacific region This view leads to proposals for a policy of containment to prevent or at least slow Chinese economic and military growth The counter argument, which might be labeled the "interdependence" hypothesis, holds that Chinese economic growth and resulting dependence on the global economy will lead to a more cooperative and less confrontational foreign policy This view leads to a policy of engagement to promote greater economic and military interdependence Current US policy is one of engagement Within a policy of engagement there is a range of choices calling for differing degrees of economic, diplomatic, technical, and military cooperation There is an active debate over degrees of cooperation in each of these areas [4]

The overall debate concerns both the *capabilities* and the *intentions* of an emergent Chinese regional power The capabilities dimension addresses how powerful China will become in economic, technical, and military terms The intentions dimension addresses whether China will become more adversarial or more cooperative as it grows into a greater regional power *This paper addresses military aspects of the capability dimension* It will also address some aspects of the technical and economic dimensions as they affect military capability.

Most assessments of Chinese military capability conclude that although the People's Liberation Army (PLA) is large, it is technically many years behind the US, Japan, or Taiwan and it will take significant long term investment before it can field a competitive regional force [5] This paper includes a summary of these assessments in Chapter III However, it has been suggested by some authors that the Revolution in Military Affairs (RMA) generated by advanced information systems and space based global surveillance and communications will enable China to make dramatic leaps in its modernization program and field a regionally competitive force sooner than otherwise projected [6]

Chapter IV of this paper specifically addresses that hypothesis -- the prospect that the RMA might enable China to become a regional military peer competitor to the US within the next ten to twenty years This assessment focuses specifically on future Chinese capability to engage in a major regional conventional conflict. It does not address use of weapons of mass destruction or so-called asymmetric strategies (such as terrorism or cyber war) to achieve political goals.

Chapter II provides some context for the remainder of the paper by looking at the evolution of Chinese threat perceptions and the prospects for future Chinese economic growth The importance of the discussion of economics is that any military modernization is completely dependent on the continuation of Chinese economic growth China cannot become a dominant regional military power unless it can sustain its economic growth Chapter III then provides an overview of the current PLA modernization program This overview looks at the trends in military expenditures in China, the evolution of defense doctrine, and the personnel policies intended to achieve a professional force Then the assessment reviews the traditional dimensions of military power ground, naval, and air forces Chapter IV analyses the RMA and China's prospects of achieving a competitive military capability through the RMA. It first examines the RMA and the kind of sensor-to-shooter architectures that China would need to develop to field the capability to make it a regional military peer of the US It then describes China's modernization efforts in space and information systems looking at both their current programs and the prospects that their technology base that would provide the capability for future programs

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[1] Lardy, "China in the World Economy"

[2] Lardy, "China in the World Economy", Lardy, "China and the Asia Contagion", and Hornik, "Bursting China's Bubble - The Muddle Kingdom?"

[3] See for example Kim, "China's Quest for Security in the Post Cold War", or Ross, "Beijing as a Conservative Power"

[4] Denny, , "The 'China Threat' Issue Major Arguments" is a good quick survey of the arguments on both sides Bernstein, Munro, "The Coming Conflict with America" and Rachman, "Containing China" argue for the "China Threat" thesis and a strategy of containment Both of these papers are incomplete in their analysis and contain factual errors Gurtov and Hwang, "China's Security The New roles of the Military", is an extensive treatment of the forces shaping Chinese security policy and argues against the "China Threat" thesis Ross "Beijing as a Conservative Power", is a short less complete presentation of the same position Perry, "Asian Pacific Security in the Post-Deng Era", and Cronin and Cronin "The Realistic Engagement of China" argue for a policy of engagement

[5] See for example, Bitzinger and Gill , " Gearing Up for High Tech Warfare? " Shambaugh, "China's Military Real or Paper Tiger?", and Gurtov and Hwang, "China's Security The New roles of the Military",

[6] Ginsberg, "Transformational Change and the Future of the Chinese Military", and Stokes "China's Strategic Modernization Implications for US National Security" Willet "East Asia's Changing Defense Industry" cites others who have made similar arguments pertaining not specifically to China but to the whole East Asia region

Chapter II Background

This chapter provides some of the background needed to assess the prospects and implications of the military modernization that is addressed in the following chapters The first part of the chapter describes China's changing threat perceptions, which influence the nature of Chinese military modernization The prospects for Chinese military modernization depend on its ability to maintain high levels of economic growth The second section of this chapter assesses the prospects for this growth over the next ten to twenty years

China's Evolving Threat Perceptions

During its first decade, the PRC allied itself with the Soviet Union (USSR) It fought the Korean War with the active encouragement and support of the USSR However, the Sino-Soviet split occurred in the late 1950's and early 1960's. The reasons included substantial disagreements over the future of the world wide communist movement, long standing border disputes dating back to the era of the unequal treaties, and a related resentment of the tendency of the Soviets to treat the Chinese as inferior partners Two events related to the PLA were the abrogation by Moscow in 1959 of an agreement to help China develop nuclear weapons and removal in 1960 of Russian technical advisers [1] The split became extremely bitter, to the point that the Chinese leaders assumed that an invasion of China by the Soviets was "inevitable".[2] The Chinese envisioned this conflict as part of a global war that would be a massive nuclear and conventional conflict This perception began to change around 1978 when the Chinese started to regard this conflict as "avoidable" [3] With the end of the Cold War, the Chinese no longer regard a Russian invasion as even a possibility and in fact are developing a strategic partnership with Russia [4]

China no longer faces a near term external threat to its existence Chinese military modernization is now focused on internal threats and threats to what it perceives to be its regional interests Internal threats refer primarily to independence movements from ethnic minorities in the autonomous regions The collapse of the Soviet Union actually made this problem worse It created four new Islamic nations on China's western border, which potentially provide support and safe haven for independence fighters In the past, the Soviet Union would have controlled this type of activity Although it is considered less likely, there are also potential splits among the Han Chinese provinces because of various regional differences [5] It is this last possibility that makes the central government extremely sensitive about its legitimacy

Chinese perceptions of their regional interests are generally somewhat aggressive [6] There are several forces driving this aggressiveness First, although China remains nominally under a communist economic system, communism as an ideology has been discredited in the eyes of nearly all Chinese This removes the founding ideological basis of the Chinese Communist Party's (CCP) legitimacy as the rulers of China The role of communism as a legitimizing ideology has been replaced by nationalism [7] China's

aggressive nationalism is thus related to the CCP's sensitivity about its legitimacy, which it perceives as critical to staying in power A second factor is the political attractiveness of the notion that China should be recognized as a great power consistent with its history. The intensity of this feeling is partly the legacy of the unequal treaties of the nineteenth century A possible third factor is that China has moved in 1993 from a position of complete energy independence to that of an oil importer and its dependence on imported oil grows each year as its economy grows [8] Energy dependence partly explains China's behavior regarding conflicting territorial claims in the South China Sea [9]

As for external threats, China's military leaders regard Japan as the principal long-term rival for regional power This perception is based partly on history and partly on a classical realpolitik calculation. Japan's military spending at 1% of GDP[10] is still substantially larger than China's and is building on a more advanced technological base Japan is far more dependent than China on imported oil and keeping the Sea Lines of Communications (SLOC) to the Persian Gulf open is for Japan a matter of basic survival When this dependence on SLOC's is combined with the possibility a future lowering of American military presence in the region, Japan is seen as forced into a position of being a dominant regional power.[11]

The other major threat seen by Chinese military leaders is the US, perceived as the only nation that currently could contain Chinese power. They also know that some prominent politicians and journalists in the US are calling for a policy of containment against China and there is concern that the US may support a move by Taiwan to declare independence A particular fear for the Chinese is that the US and Japan will "gang up" on China in a crisis [12]

China's Economic Prospects

In 1978, after more than two decades as a centrally planned economy, Chinese premier Deng Xaioping instituted a program of economic reforms The new policies permit a private sector to develop and encourage foreign investment In establishing the priorities for economic reforms, Deng laid out the "four modernizations" in the following order agriculture, industry, science and technology, and defense The order reflects the priorities and defense was the lowest priority in the 1980's

Today, the Chinese economy consists of three major sectors collective, state, and private [13] The collective sector consists of 25 million enterprises and employs 500 million people The collective sector is entirely rural and consists of farming, small manufacturing, transportation, and small business These enterprises are owned and operated primarily by rural villages The state sector consists of 100,000 enterprises with a workforce of 100 million The state sector includes most of China's large-scale industry, mining, and wholesale distribution It also includes more than one third of China's retail businesses and nearly all banks, schools, and hospitals State ownership is generally at the provincial or municipal level rather than by the national government Exclusive of Hong Kong, the private sector includes 500,000 mostly small enterprises plus over 200,000 foreign joint ventures This sector employs about 30 million Most of

this activity is located in Chinese cities [14] Direct foreign investment in China is estimated at $225 billion at the end of 1997 and is growing at the rate of $45 billion per year [15]

The private sector accounts for most of China's economic growth and most of its growth in exports The collective sector is doing well enough that rural income has tripled since 1978 In general, the state sector is losing money and is being propped up by loans from China's banks It is generally estimated that 20-25% of all bank loans in China are non- - performing [16] However, since the banks are state owned and the Chinese national debt is low, there is not an immediate danger of a banking collapse. However, the situation cannot continue indefinitely

China's Gross Domestic Product (GDP) is estimated at approximately $1.6 trillion measured by Purchasing Power Parity (PPP). China's real growth rate has ranged from 5 - 15% since 1980 and exceeded 10% from 1992 to 1995, is estimated at 9 7% in 1996, and estimated to have fallen to about 8 8% in 1997[17] and 7.8% in 1998 If even the lower growth rates of the past three years are maintained, China is estimated to become the World's largest economy in the 2010 - 2020 time frame [18]

The financial condition of the banking system raises the obvious question of China's vulnerability to the economic difficulties currently experienced by other East Asian nations. Although China is certainly vulnerable, there are some factors that make China less so in the short term than some of its neighbors One of the basic reasons for the precipitous financial collapse of other Asia-Pacific nations is that they financed long term development with short-term debt This policy leaves those countries vulnerable to rapid fluctuations in global money markets By contrast, China's growth is being financed by direct foreign investment and long term debt. There are two additional factors First, China imposes currency controls so that its currency is not freely convertable [19] This policy makes speculative attacks on their currency impossible Second, China has foreign hard currency reserves estimated at $140 billion (not including reserves held in Hong Kong) [20] These reserves are the result of China's running a trade surplus that has ranged from S12 to $40 billion over the past few years [21] This near term financial picture should provide some protection against the repetition in China of the financial collapse that occurred elsewhere in East Asia China is, however, vulnerable to possible falling demand that may result from the crisis depending in how it plays out over the next few years Beyond the immediate Asian crisis, China has serious economic problems but they are longer term and structural [22]

One aspect that may impact China's internal stability and cohesion is that its economic growth is geographically uneven The seven coastal provinces outside Manchuria and the three separately administered cities of Shanghai, Beijing, and Tianjin in those provinces are the ten wealthiest regions measured by 1994 per capita GDP (this does not include Hong Kong) In addition, these ten regions receive nearly all of the direct foreign investment They are two to three times as wealthy as the provinces and autonomous regions of central and (except for Xinjiang) western China Xinjiang and the three provinces of Manchuria are at an intermediate level in terms of both growth and income [23]

In judging the future prospects of China's military power, a key question is whether its economic growth can be sustained for the next 15 - 20 years. This question is critical for two reasons. First, the CCP has staked its legitimacy on continued economic growth and failure to deliver may result in its losing power [24] The second reason is that it takes a strong economy to support the building of a modernized military One cause for Beijing's optimism is that China has experienced substantial growth in productivity since 1978. This is in contrast with some other Asian nations whose growth has been fueled by increases in labor and capital input without corresponding increases in efficiency [25] However, as noted above, the private sector accounts for most of the efficiency growth and it is the smallest of the three sectors in terms of employment

There is substantial reason to doubt that China can continue to maintain high growth rates over the next 15 years The first is that China cannot afford the drag of the money losing state enterprises forever They are absorbing available credit, which will reduce economic growth and eventually result in a banking crisis. There are several factors that make reforming or privatizing these enterprises difficult Laying off tens of millions of workers would be socially disruptive in any circumstances One estimate is that 25 million layoffs are needed to completely restructure the state sector.[26] The difficulty is made worse by the fact that many of them are distributed around the countryside sometimes away from other economic activity.[27] The larger enterprises have become the means of support not only for their immediate employees but also for their whole communities In addition, the state enterprises provide pensions and other benefits such as hospitals and schools that are not generally available in the other sectors In a precipitous shutdown these benefits would be lost to the affected communities The number of retired workers who are supported by state enterprises and whose benefits would be at risk in a shutdown is estimated at 20 million [28] China has announced a plan to restructure and privatize the banking system and state owned enterprises The plan includes an injection of 270 billion Yuan into the banking system

There are additional economic factors that are likely to slow China's rate of growth The inflation rate in China has been averaging 10% or higher in the 1990's while the government is running deficits equivalent to 40% of their budget In addition, there is substantial overcapacity some key sectors notably in commercial real estate One consequence of these factors is that there is substantial, illegal and not accurately measurable capital outflow This is not enough to cause a panic but sufficient to inhibit the restructuring plans [29]

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[1] Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century"

[2] Weisenbloom and Spotswood 1998, Li, " The PLA's Evolving Warfighting Doctrine, Strategy, and Tactics, 1985-1995 A Chinese Perspective", and Gaddis "Strategies of Containment" describe Soviet and US consideration of joint military action against the Chinese nuclear program

[3] Gurtov and Hwang, "China's Security The New roles of the Military"

[4] Russia is viewed in the near term as a source of military hardware and technology and in the long-term economic partner in the development of the Russian Far East Weisenbloom and Spotswood, 1998 and Wash Post Nov 21,1998

[5] Starr, "Understanding China", describes a well known incident involving Hunan and Guangong Provinces Both Starr and Lardy, "China in the World Economy" describe regional fragmentation as possible but unlikely

[6] Gurtov and Hwang, "China's Security The New roles of the Military" contains an excellent discussion of Chinese national interests as the outcome of a bureaucratic rivalry between the older adherents (primarily in the defense establishment) of classical "realpolitik" model of international relations who are pushing for an aggressive nationalistic approach to regional issues and younger "internationalists" (primarily in the foreign affairs and economic ministries) who are arguing for a more conciliatory approach and for working through international organizations

[7] Kristoff and Wudunn "China Wakes" discuss the delegitimation of communism at length Kim, "China's Quest for Security in the Post Cold War", and Hua Di 1997 describe nationalism as a replacement ideology to legitimize the CCP

[8] Calder, "Asia's Deadly Triangle", Yergen 1998

[9] Calder, "Asia's Deadly Triangle", Yergen,

[10] Over $50 billion per year, Shambaugh, "China's Military Real or Paper Tiger?" This issue is discussed in Chapter IV

[11] Whiting, 1996, and Gurtov and Hwang, "China's Security The New roles of the Military"

[12] Gurtov and Hwang, "China's Security The New roles of the Military"

[13] Starr, "Understanding China",

[14] Starr, "Understanding China",

[15] Starr, "Understanding China",, Lardy, "China and the Asia Contagion",, and Fung and Lau, "China's Foreign Economic Relations"

[16] Lampton, "China", Lardy, "China and the Asia Contagion",, and Rohwer, "China The Real Economic Wild Card" A loan is defined as non- - performing when a principal or interest payment is 180 days past due

[17] CIA, 1997, Lampton, "China", and Rohwer, "China The Real Economic Wild Card"

[18] Lardy, "China in the World Economy" and "China and the Asia Contagion",, and Hornik, "Bursting China's Bubble - The Muddle Kingdom?"

[19] As part of its attempt to become a member of the World Trade Organization, China has recently agreed to make its currency convertable

[20] Lampton, "China", Lardy, "China and the Asia Contagion",, Rohwer, 1998 and Krugman, "Saving Asia It's Time to Get Radical" Krugman recommends temporary currency controls for the Asian nation affected by the current crisis

[21] Lardy, "China and the Asia Contagion",

[22] Starr, "Understanding China", is a good survey of China's structural problems

[23] Starr, "Understanding China",

[24] The point about legitimacy is argued at length in Segal, "China's Changing Shape" , Hornik, "Bursting China's Bubble - The Muddle Kingdom?" , and Kim, "China's Quest for Security in the Post Cold War",

[25] Krugman, "The Myth of Asia's Miracle"

[26] Nye, "China's Reemergence and the Future of the Asia Pacific"

[27] This is partly because of a policy of Mao who wanted economic growth to be geographically uniform and also believed distributing industry would make China less vulnerable to nuclear attack See Gurtov and Hwang, "China's Security The New roles of the Military" or Frankenstein and Gill, "Current and Future Challenges Facing Chinese Defense Industries"

[28] Hughes, "Smashing the Iron Rice Bowl",

[29] Hornik, "Bursting China's Bubble - The Muddle Kingdom?"

Chapter III PLA Modernization

This chapter provides an overview of the current PLA modernization effort After a general introduction to the PLA, the chapter describes respectively what is known about the level and trends in Chinese defense spending, the evolution of doctrine, personnel, ground force reorganization and modernization, PLA Navy (PLAN) modernization, and PLA Air Force (PLAAF) modernization.

The PLA

The PLA refers to all of the national defense forces of the People's Republic of China (PRC) That is, in addition to the ground forces, it includes the PLAN, and the PLAAF. It is, however, the national force in that it does not include regional militia forces or the People's Armed Police (PAP) The mission of the PAP is domestic security

The PLA was formed from the red armies that fought both the Japanese in World War II (WWII) and the Koumintang before and after WWII In both of these conflicts, the PLA was fighting an enemy that by traditional measures of military strength was significantly stronger. In order to prevail, the PLA fought according to the doctrine of "peoples war" which could be carried out by a large poorly equipped but highly motivated force By 1949, the PLA numbered nearly five million

From 1949 - 1992, China has engaged in 118 incidents that are classified as Militarized Interstate Disputes (MID) by the Correlates of War research group [1] The most serious incidents all occurred before 1980 These include fighting the US in Korea, conquering Tibet, fighting a border war with India, fighting in the Taiwan strait, invading Vietnam, and engaging in numerous skirmishes with the Soviets along their 3000 mile border The performance of the PLA against strong opposition has not been good The PLA was able to execute a surprise counterattack that stopped the US offensive and created a stalemate in Korea However, throughout the war, the PLA suffered huge losses compared to the Americans, who were restrained by unwillingness to risk a world war The fighting in the Taiwan Strait in 1958 and the incursion into Vietnam in 1979 were clear defeats for the PLA

In 1950, China and the Soviet Union signed the Sino-Soviet Treaty of Friendship, Alliance, and Mutual Assistance [2] This treaty provided for substantial Soviet aid in modernizing the PLA This included weapons and equipment, assistance in building a defense industry, and technical advisers Even at that time, the weapons and equipment were not the Soviet's best and the PLA even at that time lacked offensive capability Nevertheless this period represented the last PLA modernization (until the 1990's). Those weapons and equipment and Chinese manufactures based on those designs constitute the bulk of the PLA capability and the baseline from which the current modernization is proceeding

Chinese Defense Spending[3]

The first observation about Chinese defense spending is that no one, probably including the Chinese Government, has an accurate or complete understanding of its size and distribution [4] There is an entity referred to as the "official defense budget" but it contains only a fraction of total defense spending with the remainder coming from literally thousands of separate sources and no one keeps an accounting of all of them Estimates of total spending range from twice to twelve times the official total The most widely accepted estimates are that total spending is three to four times the official estimate

There are further problems associated with monetary variables, which make it difficult to estimate trends and make global comparisons The first is that even if an accurate accounting of defense spending were available, it would provide only nominal spending levels - not adjusted for inflation To understand the trend in defense spending, it is necessary to translate numbers into real dollars and there is not a widely accepted inflation index to apply to defense. The second problem, which applies to any comparative analysis of defense spending, is how to account for differences in price and wage structures This is exaggerated in the case of China by its policy of undervaluing its currency - the Yuan [5] Thus comparisons of defense spending need to use Purchasing Power Parity (PPP) which is difficult to estimate The higher estimates of total defense spending use PPP and the difficulty in estimating PPP partially accounts for the wide range in these estimates

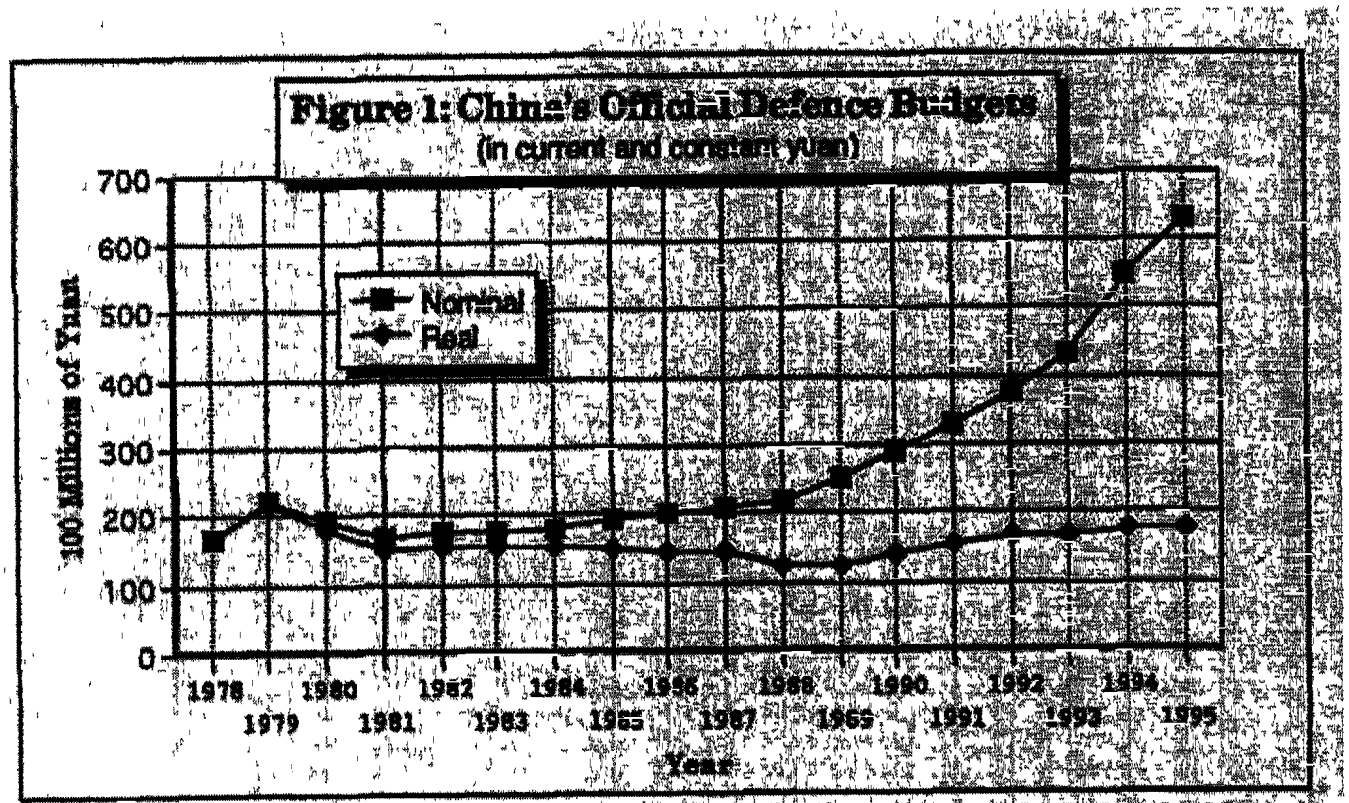
There are three major components of Chinese defense spending

- The official defense budget
- Defense related spending of other government ministries
- Income from PLA business operations

The official defense budget is the budget administered by the PLA It pays the major portion of the costs of operating and supporting the military It pays for personnel, for operation and maintenance of equipment including training, and for purchase of equipment and facilities The budget is approximately evenly divided among these three categories It is estimated that the official defense budget covers about 70% of these expenses For example, each Chinese soldier is estimated to cost about 16,600 Yuan per year At this rate, a 3 2 million man PLA would spend nearly all of its 1995 official budget on personnel (but in fact only a third of the PLA budget goes to personnel with the remainder of personnel costs coming from other sources) The official budget also pays for equipment but not for modernization or research and development

In nominal Yuan, the official budget has grown from 18 billion Yuan in 1979 to 63 billion Yuan in 1995 with nearly all of that increase coming since 1989 However, if these numbers are adjusted for inflation, as illustrated in Figure III-1, the trend is an actual decline in the 1980's followed by a modest increase in the 1990's In real terms the budget still hasn't caught up to the level of 1979 which was the year of the war against Vietnam

FIGURE III-1



Sources:

State Statistical Bureau, *Statistical Yearbook of China, 1994*, pp. 32, 217, 231; *Renmin ribao*, 13 March 1995.

There is significant defense spending that is not in the official budget and is not under the control of the PLA These are allocations managed by various other government ministries They pay for military Research and Development (R&D), and acquisition of major military equipment This component may include approximately 1,000 enterprises and 200 research institutes employing over 3 million workers including scientists and engineers Other defense spending in this category is civil defense, local militias, and the PAP.

In addition to the fact that these expenditures are spread among many ministries, they are difficult to estimate because of a program for converting defense industrial capacity to producing goods for the civilian market This conversion is part of or at least complimentary to the process of privatizing the state sector of the economy This program is far enough along that an estimated 70-80% of the defense industrial sector output is destined for the civilian market [6] However, for reasons discussed in Chapter IV, many of these firms are having trouble becoming profitable and competitive in the private sector. In many cases their continued operation depends on loans from state owned banks and these loans contribute to the banking crisis mentioned in Chapter II

As indicated above, the official budget covers an estimated 70% of the cost of personnel, operations, and maintenance The remainder comes from "extrabudgetary earnings" PLA units at every level have become involved in a wide variety of business enterprises, which currently include factories, farms, mines, hotels, and retail outlets They are also involved in import/export trade and even currency speculation The General Logistics Department (GLD) runs over 10,000 of these enterprises employing about 700,000 workers [7] Low level units may run as many as 10,000 additional enterprises many of them illegal [8] The larger scale activities include ventures with foreign investors A major example is the Sanjiu Enterprise Corporation including about three dozen PLA enterprises primarily in pharmaceuticals with subsidiaries in Germany, Thailand, Russia, and the US China United Airlines is owned by the PLAAF

Many of these business activities provide routine requirements of the military for food, equipment repair, and transportation The system originated in the 1930's out of the necessity of the widely scattered army units to be self-sufficient and originally these enterprises met basic army needs The budget stagnation in the 1980's caused a shift to running the enterprises to make a profit [9] It is still true that much of the money is used to improve the living standards of the soldiers However, some of the money goes to luxury goods for the officers and to financial speculation This system is causing several problems One is corruption, which has led to arrests of high level officers Another problem is perceived unequal and unfair distribution of profits, which causes a morale problem in an army that needs to professionalize its force In addition, these enterprises compete for materials and for time and energy of the men, which detracts from preparedness Consequently, the Chinese Government is trying to end this system [10] There are two problems with this The first is getting high level officers to put away personally profitable activities, which is causing outright insubordination and a serious civil-military problem The second problem is how to replace the money that does go to

legitimate PLA needs not covered in the official budget. This is one more expense that will delay modernization

When all three components of Chinese defense spending are included, the consensus (more or less) estimates of the total are around $28 - 36 billion (US) based on PPP Furthermore the trend for the total mirrors that of the official budget - that is slow growth This slowly growing total needs to fund PLA modernization

Evolution of Doctrine

One of the key dimensions of PLA modernization is the evolution of doctrine During the Chinese Civil War and the war of resistance against Japan, Mao Tse-Tung developed a doctrine of "people's war".[11] This doctrine was suited to the army that Mao was leading and to the wars they were fighting. The legacy of this doctrine has had and continues to have an important impact on the current condition of the PLA The doctrinal evolution summarized here is much more than an updating of vision statements and training manuals It requires a profound change to the organizational structure and the roles and missions of all elements of the PLA Many of the problems that the PLA is and will continue to face in its modernization derive from the magnitude of these changes

People's war is a strategy for a primarily agrarian nation to defeat an enemy who has superior forces [12] It differs from traditional theories of warfare by calling for flexibility about taking and yielding territory and being willing to fight a protracted war The flexibility on seizure and defense of territory is to preserve friendly forces and to tactically engage the enemy only with an overwhelming advantage The doctrine calls for gaining the support of the rural population, and using that support to build a force that eventually will be capable of destroying the enemy in a climactic conventional conflict People's war has a three-stage strategy

1. Strategic Defensive The enemy is on the offensive occupying increasing amounts of territory The strategy is to draw him in, extend his lines of communications, and weaken him where opportunities occur
2. Strategic Stalemate Guerilla warfare intended to make the enemy occupation as painful as possible
3. Strategic Counteroffensive Having built up a superior force during stage 2, counterattack and annihilate the enemy

This strategy requires a large force It engages the enemy after he has been drawn into friendly territory and weakened Other aspects are that it requires highly motivated forces that have the support of the local population This has two consequences that still impact PLA modernization First, political work with the local population is embedded in the doctrine and is regarded as being as important as combat The second consequence, which was also dictated by necessity during the Civil War and WWII, is a willingness to send forces into combat with little training The importance of these two factors is that the new doctrine described below requires a professional well-trained

force. Because of the legacy of people's war, this requires a difficult culture change in the PLA

The PLA has undergone two major changes in doctrine since its founding The first change from people's war to "people's war under modern conditions" was promulgated in 1979 but had been under development for years, possibly as early as 1958 [13] The change was a reaction to the increasing industrialization of China People's war under modern conditions is a change to the conduct of war but not to the character of war [14] The purpose of war was still regarded as defending China against a massive invasion from the Soviet Union As in people's war, the invasion was to be repelled by a massive peasant based army The difference was that instead of "luring the enemy deep into the interior of China", the doctrine called for an active defense of defeating him at the "gate" The doctrine called for achieving quick victory rather than conducting a protracted conflict and called for defending the cities and hence its industrial infrastructure.

The second change in strategic doctrine was to "limited war under high technology conditions" The change occurred in 1985[15] and is a change to both the character and the conduct of war. This change was motivated by the change in China's threat perceptions described in Chapter II The reason for war is no longer to repel a massive invasion to meet contingencies that would result not from a global conflict but from a regional crisis or border incident The Chinese have rethought the types of conflicts they need to prepare for and how their forces should be postured They have defined five wartime contingencies[16] border conflicts, contention for territorial seas and islands, surprise air attacks, resistance against partial intrusions, and punitive counterattacks against neighboring countries

One of the characteristics of local wars are that they have limited strategic objectives The military objectives are usually not to annihilate the enemy but to obtain a diplomatic advantage or intimidate or punish the enemy They are therefore limited in geographic space and in duration Thus the dimensions of time and space are completely reversed from peoples war This doctrine calls for rapidly applying a superior force to achieve a quick decisive victory The rapid defeat of the Iraqi army in the 1991 Persian Gulf War made a profound impression on Chinese military leaders The lesson they drew from that war is that high technology forces are extremely lethal and can achieve a decisive edge by striking preemptively

Personnel

One response to both the budget constraints and the doctrinal evolution described above are changes in personnel Two changes, which are already underway, are a major personnel reduction and a professionalization of the officer corps There was a personnel reduction of about a million men in the mid-1980's Many of these were transferred to the PAP or related activities that are off the PLA budget [17] An additional reduction of a half million has been announced to be implemented by 2000 This will reduce the PLA to 2 5 million Approximately half of that reduction has already occurred In this case,

some of the soldiers are being released into the economy Some Chinese military leaders have indicated that a reduction to 1.5 million is an ultimate target [18]

A second significant personnel change is the professionalization of the officer corps, motivated by three factors. The first is the need for a competent professional career officers corps to implement the doctrine of limited war under high technology conditions Additional factors are the need to assure political control of the military and to eliminate pervasive corruption [19] In 1988, the PLA promulgated regulations for officers specifying age and education requirements There is a maximum age for officers at each echelon. They have also established three levels of military education The lowest level is the military academies that provide college education plus military training and produce new officers The next level is the command colleges, which provide specialized mid career training At the highest level is the National Defense University (NDU) Upper echelon commands are increasingly exclusively staffed with academy and NDU graduates In general, the education reforms and age limits are assessed as a success in that the officer corps is becoming more professional and better educated [20] The PLA is assessed as slow in incorporating the new broad doctrinal concepts described above into detailed education and technical training [21] Full implementation and proficiency in the new doctrine may require generational change

Ground Force Modernization

Despite the budget limitations described above, PLA ground forces have received several new weapons systems including a new main battle tank and new artillery and rocket systems [22] However, the most interesting aspect of the emphasis on limited high technology war is the organizational evolution The first step was the consolidation in 1985 of the eleven PLA Military Regions (MR) into seven The second development was the formation of 24 Group Armies (GA) These are corps size units (about 50,000 men) organized into three divisions with infantry, armor, artillery and supporting elements integrated into a combined arms force [23]

In 1984, the PLA started organizing rapid reaction units The first such units were called "fist" units and were selectively distributed among the MR's The goal is that these units will be combat ready and capable of being deployed anywhere in China within 12 hours [24] Approximately 258,000 troops have been assigned the rapid reaction mission These are designated as Rapid Reaction Forces (RRF) and Rapid Deployment Forces (RDF) RRF are airborne or light infantry units who are dependent on air transportation These units are to be the first to react to a contingency The RDF consist of heavier units who come in after the RRF The 15th Airborne Army headquartered in Henen Province is regarded as the most capable of China's rapid reaction forces It consists of three brigades, which are each currently being upgraded to division size [25] The 15th was deployed in the 1989 crisis and is airlifted around China on maneuvers [26]

Further expansion of this capability is limited by PLA airlift capacity Currently, the PLA's airlift capability consists primarily of 10 Il-76's and 25 Y-8's [27] The Il-76 is a Russian made transport that can carry 125 troops over 4000 miles and land on short

rough runways. There are reports that China may purchase an additional 15 Il - 76's from Uzbekistan [28] The Y-8 is an old design that the Chinese manufacture under license Additional capability could come from use of the growing number of commercial aircraft in China but these cannot carry troops or cargo into combat zones

Naval Modernization

The PLA Navy (PLAN) is the third largest navy in the world,[29] with over 1100 ships and 260,000 personnel including marines and naval air men. However, most of these ships are coastal patrol craft, minesweepers, supply ships, or small amphibious craft It has about 50 submarines and a similar number of major surface combatants, which are a mix of frigates and destroyers Most of these ships date back to the 1970's or earlier [30]

Traditional Chinese naval doctrine was intended to protect coastal cities This was part of the doctrine of people's war. This doctrine had the navy operating as an extension of the ground forces and explains the preponderance of coastal patrol craft in the PLAN In the mid - 1980's the Navy adopted the strategic concept of "offshore active defense" as its contribution to limited war under high technology conditions This new strategy was is a response to changing threat perceptions The PLAN is being modernized to prevent Taiwanese independence, defend China's claims the South China Sea, and protect China from a sea-based invasion [31] As China becomes increasingly dependent on imported oil and other commodities, there is also the need to protect the Sea Lines of Communication (SLOC) for these imports [32] Chinese military cooperation with Burma including possible construction of a naval base on the Irrawaddy River Delta and a naval reconnaissance facility on Coco Island are regarded as an attempt to address concerns about the future security of the SLOC from the Persian Gulf [33]

The offshore active defense strategy calls for three defense rings [34] The inner line of defense is coastal defense which would be performed by a scaled back and somewhat modernized fleet of patrol craft and fast attack craft plus shore based anti-ship missiles The middle line of defense is a line called the "first island chain" which runs from the Kurils and Ryukyus down through the Philippines to the straits of Mallacca This line would be defended by major surface combatants supported by land based naval air The outer line of defense is called the "second island chain" which runs from the Bonins, through the Marianas and Carolines down to Papua New Guinea These would be guarded by attack submarines

The modernization of major surface forces includes new destroyer and frigate classes The principle surface combatant for the PLAN is and will continue to be the 16 *Luda* class destroyers which are a 1970's design [35] Since 1991, two *Luda III* destroyers with improved range and weapons have come into service The PLAN's largest surface ship at 4500 tons and its most modern is the new destroyer class *Luhu* The *Luhu* has modern European purchased electronic and anti - submarine systems and landing pads for French Dauphin helicopters Although the *Luhu* represents a substantial modernization, the total improvement may be limited by two factors The first is that they are not expected to be acquired in sufficient numbers to replace the *Ludas* Only six are currently on order and

because of its dependence on foreign systems, the final number is not expected to be much larger The foreign dependence is also expected to cause the *Luhu* to be difficult to maintain further limiting its overall impact.[36] The PLAN frigates include primarily the *Jianghu* class which is a late 1970's design. Starting in 1991, the new *Jiangwei* class became operational with four in service and six more on order The *Jiangwei* has improved missiles and electronics.

A major issue is whether and when the PLAN will acquire an aircraft carrier. According to official sources, China is not currently building a carrier and will wait until 2020 to acquire its first carrier [37] PLAN officers have expressed determination to eventually acquire carriers In addition, PLAN aviators have been practicing flight deck operations since using a simulated flight deck based on a decommissioned Australian carrier

The largest modernization effort is in the PLAN submarine fleet [38] The bulk of the current submarine fleet consists of over 40 *Ming* and *Wuhan* class conventionally powered attack submarines (SS) These are based on old Soviet designs from the 1960's and 70's. An upgraded *Ming* class (based on 1980's technology) continues to be built but the basis of SS modernization is the new Chinese designed *Song* class and the purchase of the Russian *Kilo* class The *Song* class is considered 1980's technology and will be armed with C-802 Surface-to-Surface Missiles (SSM) with a range of approximately 30-35nm The first *Songs* became operational in 1996 and the PLAN is eventually expected to acquire about 20 of them They will replace the *Ming* and *Wuhan* class The *Kilo's* are a modern SS The Chinese have bought four of them including two of the export version and two of the more capable version used by the Russian Navy The Chinese have just taken delivery of the third *Kilo*, but the PLAN did not buy the full training and support package and the *Kilos* are not yet regarded as operational

The Chinese nuclear propelled attack submarine (SSN) fleet consists of five *Han* class submarines They were developed by the Chinese and became operational in the 1970's They are regarded as noisy and extremely vulnerable In a famous 1994 incident a *Han* was easily tracked for several days while attempting to observe US carrier task force [39] The Chinese are developing a new class of SSN If the program goes well, which would be without precedent for China, the first may become operational in 2002 and a force of six to eight operational by 2020 [40]

There are three additional points worth mentioning that impact PLAN capability to project power First, PLAN amphibious capability consists of 54 landing ships with a capacity to land a brigade size force of 6100 troops and 350 tanks Chinese plans to enlarge this capability are modest and the indications are that significant enlargement is not a high priority [41] The second point is that although the anti - surface warfare capability is good, the Chinese fleet has and will continue to have a weak capability in Anti-Air Warfare (AAW) even with the modernization described above Fewer than half of the current major surface combatants have any Surface-to-Air Missiles (SAM) and what they have is primarily short range -- less than 7nm After 15 years of development, reportedly trouble plagued, the Chinese developed a *HongQi* 61 SAM which is being deployed on the new *Jiangwei's* [42] The *HongQi*'s capabilities are a substantial

improvement but it is still a short-range weapon planned for deployment on a small number of ships In a confrontation with the Philippine Navy near Mischief Reef, the PLAN backed off possibly out of concern about weaknesses in their AAW capability [43] The third point is that without aircraft carriers, PLAN ability to provide air support is quite limited For operations in the Spratlys, the nearest airfield is on Hainan Island 1000 miles away Although the PLAAF Badger could reach the area, it is vulnerable to air defense. Only the SU-27 has the combat radius to be effective and its time on station is limited by lack of in-flight refueling capability.[44]

Air Force Modernization

The PLA Air Force (PLAAF) has over 4,000 fighters but except for 48 SU-27 fighters bought from Russia, they are all Russian MIG designs from the mid - 1950's or earlier This force was originally put together during the 1950's when the PRC and Soviet Union were cooperating After the Sino-Soviet split, the main mission of the PLAAF was air defense in a massive invasion of China. The numbers of these obsolete aircraft will decline to about 2000 by 2005. The bomber force consists of about 200 aircraft that are Russian designs from the early 1950's The Chinese have no in flight refueling capability and no Airborne Early Warning (AEW) [45]

The main thrust of PLAAF modernization is the replacement of its fighter force. The initial purchase of SU-27's was mentioned above The SU-27 is a capable fighter with look-down shoot-down capability, and over the horizon radar, advanced fire control, and capability to carry both short and medium range air-to-air missiles [46] It is one of the main fighters of the Russian Air Force China has contracted with the Russians for coproduction of the SU-27 in which China will assemble the aircraft from kits The plan is for the PLAAF to acquire up to 250 of the aircraft over the next 15 years [47] If this occurs[48], the aircraft will become one of the primary weapons of the PLAAF serving the long-range interceptor role Another major modernization initiative is the development of the F-10 fighter The Chinese are working with Israeli Aircraft Industries (IAI) to develop the F-10 based on the US F-16 and Israeli fighters [49] The intent was that the F-10 would reach initial operating capability by 2000, but the program has not been going well and it is now expected that the first F-10 will not be ready before 2005 [50] If the program is successful, it will provide the PLAAF a short-range interceptor capability China has obtained four Il - 76 aircraft from Turkmenistan and has contracted with IAI to have them fitted with IAI's Phalcon AEW system The intent is to eventually have 6-8 AEW aircraft [51]

In addition to the uncertain prospects of hardware modernization, there are other factors that will impact the prospects of PLAAF modernization First, although the ground and maritime forces have accepted new doctrine to which they are building, the PLAAF does not have an accepted doctrine and strategy and there is no general agreement that an air strategy beyond support of ground and naval forces is even needed [52] A second point is that the PLAAF record of training and support is weak compared with modern air forces PLAAF pilots receive flight training time that is less than half that of US Air Force pilots and is far short of what is considered minimal for a high performance fighter like the SU-

27 [53] Weaknesses in PLAAF support capability are indicated by the fact that the PLAAF has never sustained a sortie rate better than one sortie every four to five days [54]

The large numbers of aircraft provide a significant military capability over or close to the Chinese mainland Even realizing even this capability however requires improvement in training and support However, the PLAAF is a long way from having a serious power projection capability until it can acquire modern fighters in sufficient numbers; provide adequate training and support, and acquire in flight refueling and AEW

Summary

This chapter has described PLA modernization efforts and assessed its prospects The PLA starts with a large force that is mostly obsolete both in its equipment and in its training and doctrine The PLA is reducing force size despite the fact that the reduction adds to the larger problem of streamlining the state sector of the economy. The PLA has developed a new doctrine and established an educational system to professionalize the officer corps However, fully incorporating the doctrine and achieving the needed technical proficiency will take time. In each of their component services -- ground, sea, and air -- the PLA has some forces that are actively modernizing and are either very capable by modern standards or could become capable within the next ten-twenty years However, the PLA has a long way to go to even change the balance of power in the region let alone challenge the US within that time Furthermore, the PLA would need to do this with a slowly growing or perhaps flat level of military spending since the economic problems described in Chapter 2 mean that the spending trend is unlikely to change dramatically

The next chapter will examine the prospects that the RMA and China's efforts to achieve it, might alter this assessment

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[1] Johnston, "China's Militarized Interstate Dispute Behavior 1949-1992 A First Cut at the Data"
[2] Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century"
[3] The data for this section is from Wang 1996, Gurtov and Hwang, "China's Security New Roles for the Military" , and Shambaugh, "China's Military Real or Paper Tiger?"
[4] Shambaugh, "China's Military Real or Paper Tiger?"
[5] The reason for this policy is to encourage exports maintaining a favorable balance of trade This is one of the factors that gives China some protection against the immediate effects of the current Asian economic turmoil
[6] Wang, "Estimating China's Defense Expenditure Some Evidence from Chinese Sources"
[7] Bickford, "The Chinese Military and its Business Operations"
[8] Gurtov and Hwang,"China's Security New Roels for the Military" Illegal activities include use of military property for criminal purpose, pirating of software and compact discs, and smuggling operations
[9] Bickford, "The Chinese Military and its Business Operations"
[10] FBIS 28 April 1998
[11] There is a point that needs clarification regarding the word "doctrine" In this chapter, "doctrine" refers to military strategy Tactical doctrine is not addressed Chapter V, which describes the Revolution in Military Affairs (RMA), explains that an RMA includes technology, doctrine, and organization In that discussion, "doctrine" refers to both strategy and tactics The evolution of PLA strategic doctrine that is described in this chapter was originally motivated by changes in Chinese objectives and threat perceptions

Subsequently, those motivations were strongly reinforced by a recognition, based on observing the Persian Gulf War, of the importance of the RMA

[12] The references contain selected writings of Mao on which this description is based See also Gurtov and Hwang, "China's Security New Roles for the Military" and Shy and Collier "Revolutionary War" in , "Makers of Modern Strategy from Machiavelli to he Nuclear Age", Paret ed

[13] Gurtov and Hwang, "China's Security New Roles for the Military"

[14] The "character" of war refers to who fights and why The "conduct" of war refers to how they fight

[15] Gurtov and Hwang, "China's Security New Roles for the Military"

[16] Gurtov and Hwang, "China's Security New Roles for the Military", Godwin, "From Continent to Periphery PLA Doctrine, Strategy, and Capabilities towards 2000"

[17] Shichor, "Demobilization The Dialectics of PLA Troop Reduction"

[18] Shambaugh, "China's Post - Deng Leadership New Faces, New Trends"

[19] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection"

[20] Dreyer, "The New Officer Corps Implications for the Future" contains an extensive description and assessment of these changes Shambaugh "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection" and Gurtov and Hwang, "China's Security New Roles for the Military" echo the overall assessment

[21] Dreyer, "The New Officer Corps Implications for the Future"

[22] Jacobs, JIR August, 1993

[23] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection", Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century", and Gurtov and Hwang, "China's Security New Roles for the Military"

[24] Gurtov and Hwang, "China's Security New Roles for the Military", Allen, Krumel and Pollack, "China's Air Force Enters the 21st Century"

[25] Allen, Krumel and Pollack, "China's Air Force Enters the 21st Century", and Jacobs op cit

[26] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection", Jacobs op cit describes the organization of these units

[27] Allen, Krumel and Pollack, "China's Air Force Enters the 21st Century", and Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection"

[28] JDW June 1997

[29] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection"

[30] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection", JIR March,1996

[31] Gurtov and Hwang, "China's Security New Roles for the Military"

[32] JIR July 1997 and Calder, "Asia's Deadly Triangle" Both of these references describe the increasing military ties between China and Burma including the prospect of Indian Ocean basing rights for the PLAN as an aspect of defending the SLOC's to the Persian Gulf

[33] JIR July 1997

[34] Gurtov and Hwang, "China's Security New Roles for the Military" and JIR March 1996

[35] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection" and JIR June 1994

[36] Shambaugh "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection" and JIR April 1996

[37] Shambaugh, "China's Post - Deng Leadership New Faces, New Trends" , JDW June 1998, and a statement by Maj Gen Gong Xianfu at a Wilson Center Conference on PLA modernization Nov 1998

[38] The sources for submarine modernization are JIR June 1994, JIR March 1996, and ADPR October November 1998

[39] JIR March 1996

[40] The Chinese also developed a nuclear propelled ballistic missile submarine (SSBN) called the *Xia* in the 1970's and 80's The program was trouble plagued and the Xia has never conducted an operational patrol and is not considered operational The Chinese started a successor program but the development of the DF-31 and DF-41 mobile land based missiles may have superceded the program

[41] JIR April 1996 Supporting this point is that the Chinese built no amphibious craft at all from 1950 to 1980 JIR June 1994

[42] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection" and Frolov, "The PLA's Naval Buildup in the 1990's A Political as Much as a Military Message"

[43] JIR June 1994 and March 1996

[44] JIR March 1996

[45] Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century", and Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection"

[46] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection"

[47] JDW June 1998

[48] There are two reasons to question whether this will happen The first is the weakness in Chinese aerospace manufacturing as cited e g by JDW January 1998 and June 1998 The second reason is expense Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century" express doubt about the ability of the Chinese to afford the modernization described in this paragraph

[49] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection", Allen, Krumel, and Pollack "China's Air Force Enters the 21st Century", and Gurtov and Hwang, "China's Security New Roles for the Military"

[50] JDW January 1998

[51] JDW June 1997

[52] This debate is described in Gurtov and Hwang, "China's Security The New roles of the Military", and Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century"

[53] Shambaugh, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection" Two factors amplify the impact on proficiency of inadequate flying hours The Su-27 and the F-10 (if it is built), represent a two to three generation jump in the level of sophistication and performance of fighter aircraft for the PLAAF The second factor is the need to learn nighttime, all weather, and over the water operations which according to Shambaugh are new to the PLAAF

[54] Allen, Krumel, and Pollack, "China's Air Force Enters the 21st Century" provide a history of PLAAF operations The point about sortie rate and its implications was also made by Allen at a Wilson Center symposium on the PLA in November 1998

Chapter IV PLA and the Revolution in Military Affairs (RMA)

RMA and Its Implications

The overwhelming victory of the US and its allies in the Persian Gulf war created a perception that there has been a Revolution in Military Affairs (RMA) This perception is that the combination of sensor technology, information technology (including communications), stealth, and Precision Guided Munitions (PGM) has created fundamental differences in how wars will be fought in the future The sensor and information technologies will, in this report, be subsumed under the generally used acronym C4ISR, which stands for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance C4ISR specifically refers to the sensor, computer, and telecommunications systems employed directly in planning, executing, and assessing military operations.[1] It is the combination of C4ISR and PGM's that enabled the US to conduct extensive attacks in densely populated areas with minimal civilian casualties Stealth is a third critical technology[2] which had the effect of enabling decapitating strikes -- which go after very high value and very heavily defended targets -- against Iraq early in the war with minimal US casualties [3]

The term "Revolution in Military Affairs" or RMA evolved from an earlier term "Military Technical Revolution" which was originally a Soviet term As early as 1984, the Chief of the Soviet General Staff, Marshal Ogarkov expressed alarm about the emergence of "automated reconnaissance and strike complexes" and long range precision weapons that could render conventional weapons nearly as destructive as nuclear weapons [4] The term "RMA" has been adopted because it is intended to convey more than simply an insertion of technology An RMA occurs when the insertion of new technology is combined with organizational and doctrinal change to produce a fundamental change in the character or the conduct of warfare [5] That the change is fundamental means that future adversaries "must match or counter the new combination of technology, organization, and doctrine in order to prevail"[6] in conventional military terms Krepinevich (1994) provides an interesting perspective by describing ten instances since the fourteenth century in which an RMA can be considered to have occurred By the standards of this definition, the conduct of the US in the Persian Gulf war did not constitute an RMA since in that war the technology was inserted into the existing organizational structures and carried out existing doctrine Nevertheless, Galdi[7] describes the efforts of the US Defense Department (DoD) to make the organizational and doctrinal changes justifying the conclusion of Welch and Cohen (1996) that we are in the early stages of an RMA

Even if the conduct of the Gulf War was only an insertion of technology rather than a full RMA, there was a dramatic improvement in effectiveness from the use of PGM's, precision targeting, and stealth In the case of air power, the Gulf War Air Power Survey (GWAPS) provides convincing data In the Gulf War there was a thirteen to one improvement in the ratio of sorties to aimpoints between those using PGM's compared with those using unguided bombs There were some targets such as Sector Operations

Centers (SOC) and dug in armor in which unguided bombs were completely ineffective Comparisons with the Korean War - which represents the current state of the PLAAF - credit PGM's with a 550 to one improvement in sortie-to-aimpoint ratio [8]

This improvement in capability has several tactical and strategic implications At the tactical level, it means that wars would be fought at an extremely rapid tempo and that there is a premium on striking quickly against the enemy's C4ISR Another change is that the increased lethality of weapons combined with the ability to deliver them from great distance implies that massing troops and equipment is no longer tactically sound The emphasis is now on smaller, more mobile forces Tactical doctrine will call for massed effects rather than massed forces [9]

From a US perspective, there are several strategic implications The combination of a dramatically reduced sortie to aimpoint ratio and stealth technology implies that the US can take military action with significantly lower risk to its forces In addition it can attack enemy centers of gravity with relatively minimal collateral damage [10] Both of these factors will significantly impact the willingness of the American public to support overseas military operations [11] A second point is that the US superiority in C4ISR provides it, in some circumstances, with an additional strategic option of providing an "information umbrella" in which it shares its "dominant situational awareness" with its allies.[12] However, the strategic question, which is the focus of this chapter, is whether the RMA provides China with opportunities to achieve regional military parity more quickly or is a barrier which will make it even more difficult for China to achieve regional military parity

Some authors have argued on the basis of very general considerations that China is capable of achieving "its own form of RMA" and at the same time staying within its economic and budgetary constraints [13] It is not entirely clear based on these writings what capabilities this "form of RMA" would include A few possible elements that are mentioned include land based mobile missiles capable of attacking US carriers, dual use commercially available surveillance and information technology, and Unpiloted Combat Aerial Vehicles (UCAV) These specific notions are each discussed further below. The questions these arguments raise are Could China achieve these and other capabilities within its budget constraints and could these capabilities add up to the "prospect that China may challenge the United States' power in Asia sooner than anticipated"?[14] The remainder of this chapter argues that on the contrary *for purposes of prevailing in a conventional regional conflict*, the RMA significantly increases the gap between China and the US and its allies It is important to be precise on this point Some of the technologies described below may enable the Chinese to employ some of their modern weapons more effectively However the most optimistic achievable improvements, at least in the next ten to twenty years, will not add up to an RMA and would fall far short of significantly altering the regional military balance or reducing the tactical and strategic benefits of the RMA to the US

The key point that drives this conclusion is that the RMA is being enabled not just by the technologies themselves but by the *integration* of these technologies into *"sensor-to-shooter" architectures* This phrase is used rather than Adm Owens' term "System of Systems"[15] in order to emphasize the need for sensors, communications, command centers, platforms, and weapons systems to be integrated with a purposeful seamless real time flow of information. Furthermore, these architectures need to be built on a scale that enables destruction or at least disabling of enemy centers of gravity in the initial stages of a major regional conflict. This is what the US did in the Persian Gulf War with the strategic bombing campaign As impressive as that operation was, it was only a precursor of the true RMA In that operation, the C4ISR developed the target folders and handed them off to the shooters (i e the attack pilots). Although it is premature to speculate on the exact shape of the RMA when it matures, the vision is that platforms and even the precision weapons will receive targeting updates and perhaps new or altered tasking from external C4ISR as they ingress and provide an initial battle damage assessment as part of or concurrent with the initial strike These capabilities, if realized, would create another order of magnitude increase in both speed and lethality over that achieved in the Persian Gulf War and consequently further alter strategic and tactical calculations as described above

The remainder of the chapter is in three sections. The next section describes the elements of a sensor-to-shooter architecture with emphasis on the surveillance and communications capabilities needed for any "form" of the RMA [16] The assessment of China's prospects for achieving such a capability forms the next two parts The first examines their present programs, concluding that nothing in these programs will achieve any "form" of the RMA within the next twenty years [17] The second part examines whether China's Military Industrial Complex (CMIC) has a technology base that could support a serious move towards building the kind of sensor-to-shooter architectures needed for the RMA That assessment concludes that in most of the critical C4ISR technologies, China is two or more generations behind the US and its technically developed allies

Sensor-to-Shooter Architectures

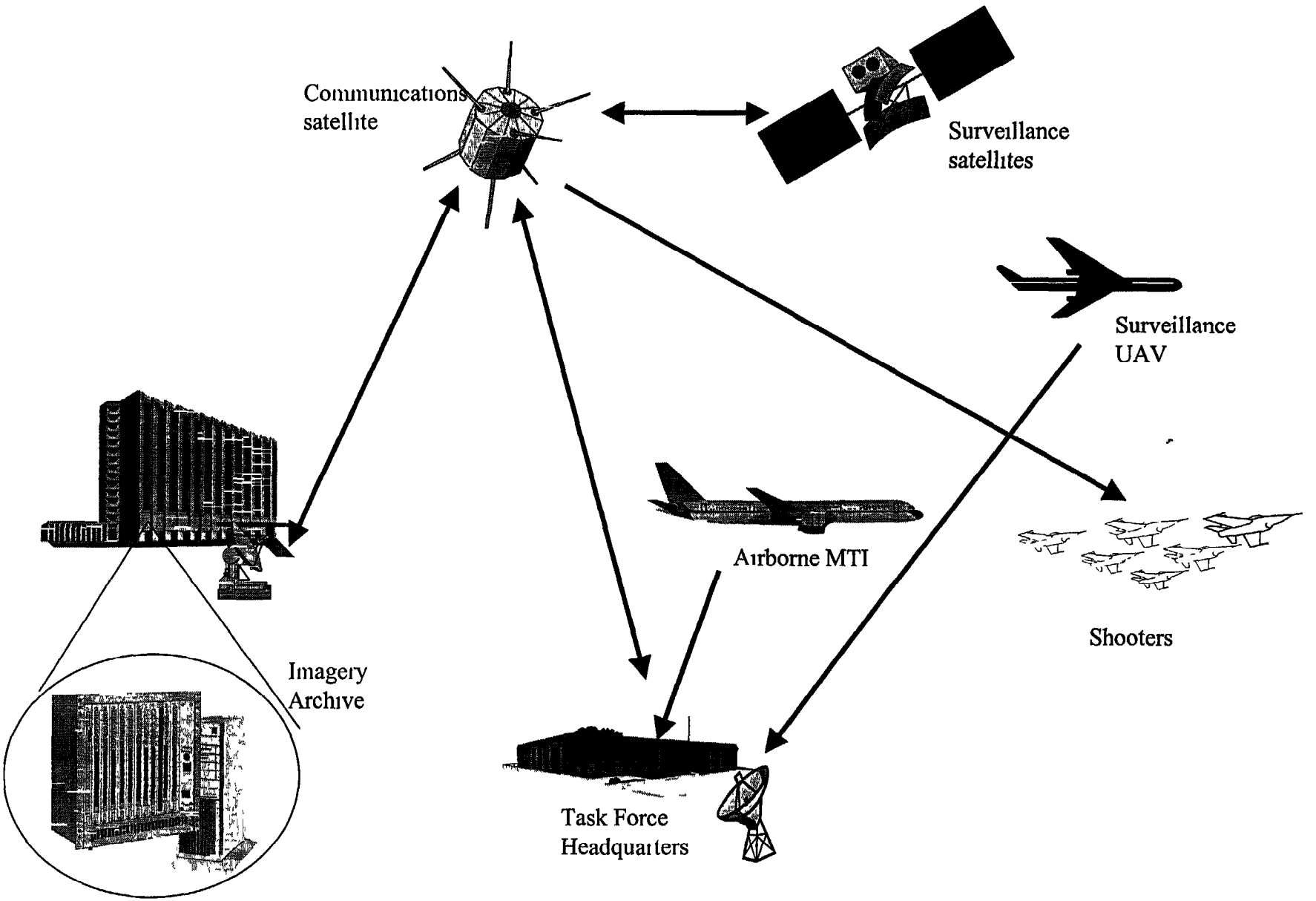
The insertion of technology that enables the RMA is the integration of a comprehensive set of technical advances into a seamless sensor-to-shooter architecture Critical technology areas include sensors, information systems including communications, platforms, and PGM's A sensor-to-shooter architecture needs to include some elements of all of these technologies and furthermore, they need to be strung together in a coherent way to add up to an operational capability The vision of the RMA is a network that is capable of constantly updating a commander's picture of the battlespace and enabling platforms and weapons respond to constant replanning and retargeting This operational concept is called "Network Centric Warfare ",[18] a concept intended to render the traditional notion that "no plan survives initial contact with the enemy"[19] obsolete Plans are perishable because situation awareness is perishable and only periodically updated In network centric warfare, updates are nearly constant and those updates are available in real or near real time to planners and when appropriate to the platforms and weapons

Figure IV-1 illustrates the elements of a notional sensor-to-shooter architecture It includes space and airborne imagery and Signals Intelligence (SIGINT) sensors For a major land battle, it would also include Moving Target Indicator (MTI) radar It includes very large imagery and mapping data bases, processing and correlation capability to update that data based on new sensor inputs; planning and targeting systems to employ weapons (shown as shipborne in the figure); space based meteorology and high precision navigation, and high capacity communications links to weapons platforms and to missiles themselves Although this architecture is notional, it illustrates the need for leading edge capability in sensors, information storage and processing, and communications

A concrete example that illustrates many of these features is the Rapid Targeting System (RTS)[20], which is deployed to Vicenza Air Base in support of operations in Yugoslavia In that case there is an Intelligence, Surveillance, and Reconnaissance Cell (ISARC) at the base, where archived imagery is compared to real time airborne reconnaissance to provide precise targeting information to support PGM's. This information is forwarded to the attack aircraft cockpit through the high capacity Rapid Imagery Transmission to Aircraft (RITA) video data link

There are several points about these architectures that deserve mention because they illustrate the points made above and will bear on some of the points made below The first is the importance of both space based and airborne imagery Space based imagery provides the data, which is collected in peacetime, for archived mapping and imagery [21] During a crisis leading up to a conflict it also provides the detailed imagery used for target planning However, imagery satellites are generally in low earth orbit and consequently are available only periodically. Steady state surveillance needed for sustained operations needs to come from airborne assets This leads to the second point, which is the importance of the Suppression of Enemy Air Defense (SEAD) mission and the resulting importance of space based SIGINT Airborne surveillance cannot operate effectively until the SEAD mission has been accomplished [22] Therefore, SEAD has to be accomplished in the early stages of an operation and consequently, in some scenarios before there is a fully deployed or built up infrastructure Generally, Surface to Air Missiles (SAM) are detected and located by SIGINT detection and location of the emissions from their search radars Modern long range SAM's are mobile In the aftermath of the Gulf War, even third world opponents are capable of operating them with some (although less than full) effectivelness by turning their radars on very briefly and moving quickly What all this means is that SEAD requires a sensor -to-shooter architecture that achieves initial detection to weapon on target within very short timelines Fortunately, some space based SIGINT can be placed in orbits that provide extended steady coverage. The architecture needs to detect, process, locate, and assign the target to a weapons platform, and communicate the targeting information within timeline of the missile's ability to relocate [23] This is a very demanding portion of the sensor-to-shooter architecture

FIGURE IV-1
Notional Sensor-to-Shooter Architecture H



If the architecture is to support the RMA in a major regional conflict it needs to be built on a scale adequate to support the information needs of the conflict To appreciate the scale of the architecture, consider again the strategic air campaign of the Persian Gulf War That operation flew 10,000 sorties in just the first 10 days [24] The portion of those sorties that were attacks against ground targets required targeting folders containing processed intelligence including detailed imagery [25] Using all the resources available to the task, it required five months for planning that campaign with the technology and systems of 1990. Among the reasons it took that long was the need to collect recent imagery, limitations in the capacity to process and analyze the new data, and to develop the targeting folders

Both the scale and nature of these architectures impact the need for high capacity battlefield and wide area communications For example, both the SEAD architecture and a missile warning architecture would require real time communications from space based sensors through intermediate processing and decision points, which are generally out of the area of operations, to the weapons platform, which would be an aircraft and missile battery respecively For strategic bombing or long-range missiles, targeting updates require transmission of imagery data to cockpits or fire control centers Imagery data may require high capacity communications Therefore all of these architectures need high capacity links on the battlefield and high capacity wide area communications

Wide area communications for the US means global communications. A putative regional power like China might get by with something less than global coverage but will still need a wide area regional communications capability to challenge the US or its allies in the West Pacific High capacity wide area communications to and from an area of operations during a war depends on satellite communications [26] To illustrate the scale needed to support the RMA even as far as it has developed since 1991, the total wide communications into the Bosnia as of early 1995 was approximately three times greater than the capacity used in the Persian Gulf War, [27] which was in turn several times greater than what was planned during the Cold War to be available between the US and Europe for a NATO Warsaw Pact conflict. For battlefield communications it is very difficult to build a high capacity link to or from a small mobile platform This problem is pushing the technology limits even for the US and is having a direct impact on future US C4ISR architectures The problem becomes even more difficult if the link needs to work in the event of enemy disruption as would happen in a regional war

In addition to considerations of scale and capacity, a critical aspect of the C4ISR is the quality of the data In the case of imagery, quality is measured by resolution which measures the distance between objects that can be distinguished The following are a few numbers, based on established imagery interpretability standards[28], that will bear on the discussion below of potential future Chinese capability It takes a resolution of 5-9 meters (m) to detect a medium size port or distinguish taxiways and runways at an airport A resolution of 1m will describe ships, identify types of large fighter aircraft, large military vehicles, and artillery, and detect but not identify large radar antennas That level is probably adequate to target parked aircraft on the ground Actual

description of buildings, missile sites, and radars, which is the level needed for precision strike, requires 0 1 - 0 3 m resolution [29]

At this point it is worthwhile to reviewing one of the arguments behind predictions of the spread of RMA capability to many nations perhaps on a smaller scale than the US is pursuing The argument notes that " the essential technology of the system of systems derives almost entirely from the civil economic base "[30] In addition to civilian markets, the global arms market includes substantial capability. Dibbs[31] points out that the global arms market now includes " . Satellite photography with a resolution of one meter, military surveillance satellites (both electro-optical and synthetic aperture radar), airborne early warning (AEW), airborne refueling, [accurate sophisticated missiles], . secure communications and cryptological equipment". Dibbs disagrees with the argument that the combination of civilian high technology and global arms markets will result in the proliferation of RMA He points out that all of the Asia Pacific nations, not just China, are deficient in joint force doctrine, support and maintenance, and systems integration skills In the case of China, the first two of these points were discussed in Chapter III and the third point is discussed later in this chapter. There is however a more fundamental point regarding this argument that the RMA can be obtained from commercially available technology Upon close scrutiny it turns out to be based on an incomplete understanding of what it takes to implement the RMA and what is really available on the market It is true that many of the technologies -- namely those for which there is enough consumer or business demand for a commercially viable market -- are available commercially In those cases what is available is often state-of-the-art. However there are many technologies that are necessary parts of any sensor-to-shooter architecture for which there is no significant market and what is available on the global arms market is far from state-of-the-art [32]

Two examples that illustrate this are satellite imagery and communications Imagery with a resolution of one meter will soon become commercially available, but as indicated above that resolution is inadequate for precision strikes against buildings, missile sites, and radars Furthermore, precision strike requires a volume of recent imagery that no combination of commercial satellites could support This imagery is an example of a point made earlier it could be used to improve weapons effectiveness and there is a potential that in a conflict with China the availability of this imagery could cost lives or property However, even if this happens, which is far from certain, it does not amount to an RMA that could cause a significant change to the regional military balance

The second example is communications There are many features of any military communications architecture (even one tasked with an easier job than supporting the RMA) for which there is no commercial demand [33] Some examples include jam resistance, survivability against loss of nodes in the network, and precedence and preemption In addition to these "military unique features" there is an additional factor relevant to the sensor-to-shooter architectures There is little or no commercial demand for high capacity communications links to mobile users in small platforms [34] Yet the whole concept of the RMA is real time targeting update (which may be large imagery files) to small platforms (such as aircraft or missile warheads) Global communications

to small mobile users is becoming commercially available but these commercial systems are low capacity, not jam resistant, and often not available in extremely remote regions

Finally, it is worth noting that at the shooter end of these architectures, the US is developing technologies that will enable it to continue fielding more advanced weapon systems well into the middle of the 21st century The current precision strike platforms are the F-15E, the F-117, and cruise missiles [35] During the Persian Gulf War, the aircraft needed to be within line of sight of their targets in order to fire PGM's. The newer Joint Stand Off Weapon (JSOW) and later Joint Air-to-Surface Stand Off Missile (JASSM) will provide, as their names indicate, a stand off capability.[36] In that conflict, all of the sorties over the most intense air defense, namely Baghdad, were flown by F-117's because of their stealth The success of stealth is indicated by the fact that none of these aircraft were lost or even damaged in the Persian Gulf War [37] Relatively near term future capabilities include the developing F-22, which will incorporate more advanced stealth technology and advanced avionics in an air superiority fighter [38] Beyond the F-22, the Air Force is researching such concepts as a hypersonic plane that could achieve sub-orbital flight and attack any point on Earth within a half hour of takeoff[39] from a base in the US, a possible successor to the F-111 for long range supersonic interdiction[40]; and an UCAV that could be used for high risk missions [41] Since the notion of obtaining a UCAV was cited as one of the possibilities that might enable China to achieve a limited "form" of the RMA,[42] it is worth mentioning that flying a UCAV requires development of a highly capable on board system to control the aircraft and operate the weapons systems based on remote commands together with a high capacity jam resistant tactical data link to provide real time visual feedback to a human operator and to receive commands from the operator Both of these are technically difficult capabilities to develop and could not be obtained commercially Ground and naval forces are also moving ahead with advanced technologies For ground forces, in addition to advanced missiles, work is focusing on "remote warfare" concepts such as remote weapons, robotics, unattended ground sensors, and a UAV that would scout ahead of attack helicopters and warn of dangers [43] The US Navy is developing a "stealth ship" (the DD-21) that should enter the fleet around 2010, and will incorporate substantial electromagnetic signature reduction [44]

China's Space and C4ISR Programs

This section assesses China's space and C4ISR efforts to judge how they match up to the sensor-to-shooter architectures described above The discussion of Chinese space systems is split into launch capability and payloads It is the payloads that provide actual C4ISR capability.

Chinese space launch capability is substantial The Chinese decided to develop a launch capability in 1958 and had their first successful launch in 1970 [45] They have developed a series of launch vehicles designated *Chang Zheng* (CZ) ("Long March") They have also built three launch complexes each with a location and design optimized for an orbital type The *Shuang Cheng Tzu* Launch Center is for Low Earth Orbit (LEO), The *Xi Chang* Launch Center is for Geosynchronous Orbits (GEO), and the *T'ai Yuan* Launch Center is

for Sun Synchronous Orbits (SSO) An additional point about Chinese capability is that they are only the third nation [after the US and USSR/Russia] to successfully deorbit and recover a satellite.[46] The Chinese have successfully entered the global space launch business, competing very well with Europeans, Russians and Ukrainians, offering a 30% cost savings but with a higher risk of launch failure compared to the Europeans.

The CZ-2 is a family of launch vehicles Most launches were by CZ-2C's, CZ-2D's, and CZ-2E's which can carry increasingly heavy payloads into LEO Depending on the particular orbit inclination and altitude, the payloads vary from 450kg to 3100kg [47] By US and Russian standards, this is considered a medium lift capability falling far short of the capability of the US Titan IV or Space Shuttle. The CZ-3 is a variant of the CZ-2 but sufficiently different to get a new designation The CZ-3 is used for launches into GEO, which is primarily for communications satellites.[48] The CZ-4 is also a CZ-2 derivative used for SSO launches of meteorological satellites Both the CZ-3 and CZ-4 are also medium lift vehicles.

One Chinese ambition is to develop a manned space capability This is interesting and has caught the attention of Western observers but almost certainly has no direct military significance (although it is possible that there could be military benefits from technical spin-offs) [49] The Chinese have in the past openly denied the existence of this program but news of it has recently appeared in the Chinese press [50] During the 1980's, both the US and the USSR offered to train and fly a Chinese astronaut but neither offer came to fruition [51] There are reports that China is developing a four man spacecraft that could be launched from *Shuang Cheng Tzu* The Russian Press has reported that the Chinese are purchasing equipment that would be associated with manned space flight These include emergency rescue, thermal control, docking joint, and a complete Soyuz life support system In addition, Russian sources at the *Zvezdny Gorodok* cosmonaut training center have confirmed, despite explicit Chinese denials, that up to 18 Chinese have arrived there for flight training [52]

In terms of payloads, which represent the actual C4ISR capability from the space program, China has launched seventeen imagery reconnaissance, eight communications, and three meteorological satellites through 1997 [53] The reconnaissance satellites are designated *Fanhui Shi Weixing* [trans "recoverable test satellite"] (FSW) The first series were called FSW-1's Fourteen of these were launched between 1974 and 1992 They weighed about 1800kg and had operational times on station of between three and eight days [54] The second series are called FSW-2's and were first launched in 1992 Three of these have been launched through 1997 They weigh about 3000kg and have an operational time on station of about 16 days [55] The resolution of the FSW-2 satellites is approximately 10m [56] A different type of imagery satellite is the *Ziyuan*, which is a commercial satellite jointly developed by China and Brazil This has an electro-optical sensor that provides real time transmission to the ground Since China does not have a communications relay capability, the *Ziyuan* needs to be within line of sight of the ground station when transmitting the image down The Ziyuan has a resolution of 19 5m [57] These satellites have been successfully used for land survey applications[58] but

based on the discussion in the previous section, they fall far short of both the capacity (due to very little time on station) and resolution to support the RMA

China's strategic SIGINT capability consists primarily of ground stations located throughout the country,[59] situated primarily to monitor signals from Russia. In fact, in 1978, the CIA helped the Chinese set up two stations in Xinjiang to monitor the Soviets China has only launched one dedicated SIGINT satellite since 1976 It stayed on orbit for about two years There are rumors that there may be SIGINT capabilities on their communications satellites They have stations near Beijing and on Hainan Island to monitor international satellite communications The Chinese also have seven SIGINT ships and a turbo prop aircraft for tactical airborne collection None of these capabilities have the capacity or survivability to support the RMA in a major regional conflict

In telecommunications, China is contracting to European and American firms to build a national infrastructure. Most military long haul communications would use this infrastructure The terrestrial portion of this infrastructure is a high capacity fiber network [60] There are also wireless networks going up in many parts of China. In this area, China is attempting to set up a low cost manufacturing capability for handsets tailored to the Asian market and based on imported chips and designs [61] China will also have a gateway for the global Iridium systems to become available in China
China has contracted with Hughes for a commercial communications satellite but the export license for that satellite has recently been turned down [62] China is considered likely to seek alternative sources There is a Global Mobile Satellite Information System (GMSIS) in some stage of research and development that would provide personal mobile communications service similar to the Iridium system

The Chinese have had limited success with military satellite communications Their military communications satellites are designated *Dong Fang Hong* [trans "East is red] and were developed in conjunction with Germany Between 1984 and 1986, the Chinese have launched three DFH-2's The first of these suffered a launch failure, the second and third were operational with the third operating until late 1990 It reportedly had approximately 1200 voice channels which is about one tenth of the capacity of the old US DSCS II communications satellites The first of the next generation communications satellite was launched in 1994 but problems with its attitude control systems caused it to be abandoned The Chinese purchased a satellite from Hughes but lost it due to a CZ-3 launch failure [63] Currently the PLA is dependent on commercial satellite communications

Two additional Chinese space activities deserve mention The first is the satellite series designated *Feng Yun* (FY) [trans "Wind and cloud"] for meteorology and remote sensing Two FY-1's were launched into SSO in 1988 and 1990 The first operated for 39 days The second operated for a few months but was lost due to attitude control problems [64] The second activity is the extensive Telemetry Tracking and Control (TT&C) system, headquartered at Xian It has six fixed stations located around China plus three land mobile and three ship based tracking stations [65] A newly constructed facility at Kiribata in the Gilbert Islands is also part of this network The Kiribata station

is regarded by some observers as a possible space surveillance capability that could in the future become part of a Chinese anti-satellite capability.[66] Overall, industry observers regard this network as world class and expect China will soon enter the commercial satellite management business as a cost competitive alternative to US services [67]

China's Defense Industrial and Technology Base

The previous section established that the current programs in space and communications, even if they are fully and successfully implemented, fall far short of providing the capability needed for even a limited "form" of the RMA That analysis leaves open the question of whether that is the result of inadequate financial resources and prioritization or if there are more fundamental reasons This section bears on that question by examining the available evidence addressing whether the Chinese Military Industrial Complex (CMIC) has the capability to implement the RMA even if the financial resources were available

In assessing this question, there is an important point that deserves mention up front The capability of a corporation, government agency, or other institution anywhere in the world to execute successfully a high technology program (such as a satellite, combat aircraft, or large scale software project) is much more than the sum total of the capabilities of the individual scientists and engineers who are working in the program and the hardware and software tools they use for design, development, and production Rather, it is the ability of the institution to integrate these people and tools Large-scale systems integration is both a technical and a managerial challenge and is generally regarded as the most difficult aspect of high technology systems development An additional point is that when high levels of technological sophistication or complexity is involved, the work needs to be distributed among several institutions to take advantage of specialization and expertise Large-scale systems integration involves the embedding of people, hardware, software, and the processes by which they interact into an organizational culture that requires years to develop [68]

China has a large number of world class scientists and a substantial program of basic scientific research although, importantly, this tends to be restricted to research that does not require large financial investment [69] These scientists are a national asset for China but they do not directly translate into a CMIC technology base It is important that both the industries themselves and the government agencies that oversee their work develop a track record of successful systems development and integration Based on the assessment in the previous section, CMIC has not yet really begun to establish that track record for the most technologically complex systems Therefore whatever the results of assessments of the relevant specific technologies, it is critical to note that the CMIC has no demonstrated (i e based on their track record) institutional capability in large-scale systems integration [70]

The CMIC consists of two types of structures The first includes about 2000 enterprises called "defense industries" that operate under the State Council. The second consists of

enterprises called "military industries" and operate directly in the PLA chain of command [71] The Commission on Science, Technology, and Industry for National Defense (COSTIND) was established in 1982 to centralize decision making on the development and output of Chinese military production [72] Looking at the CMIC as a whole, there are two broad factors that will inhibit its progress towards modernization the "Third Front" and the process of defense conversion

The third front was a program in the 1960's and 1970's that moved a large part of the CMIC to remote areas of southern and western China The intent was to obtain some survivability in the event of the Soviet invasion that was considered the main threat at that time.[73] Approximately 55% of defense industries are in third front areas These areas are remote, cut off from the rapid economic development of the urban coastal regions and the transportation infrastructure, and they are heavily in debt In addition, they lack skilled manpower and management expertise and cannot recruit this talent from other parts of the country.

Defense conversion is the process of converting defense industries to the production of civilian goods The intent is to privatize the defense industries to put them on a sound financial footing Related to this effort is an emphasis on dual use technology -- technology that has both a commercial market and military applications The hope is that there will be spin-offs that benefit military modernization. The defense conversion effort has resulted in over 70% of the output of the defense industries being civilian goods [74] Most of the financial success has occurred in goods with high labor but low capital or technical inputs. In other areas, the converted defense industries do not do well in competitive markets The reasons are poor management, quality control, market research, and cost control Even after conversion, these industries continue to loose money They have not made the organizational culture change from being government agencies to being profit-seeking corporations [75] This change would be only the first and most basic of the changes needed to become players in the extremely dynamic leading edge high technology business

The Chinese have an umbrella program for long term development of science and technology called the 863 Program [76] The program encompasses both civilian and military technologies It is managed by COSTIND and has cited both space and information systems as key areas for development Within information systems Integrated Circuits (IC), software, and artificial intelligence are cited as key enabling technologies IC's are a critical component of sensors and space systems and a globally competitive self-sufficient capability would be essential for China to achieve the RMA given its potential status as an adversary of the US [77]

In imagery satellites, China is developing the FSW-3, which is expected to have a resolution of one meter This resolution would make it competitive with capability that is about to become available from commercial imagery [78] As with the rest of the FSW series, it is a recoverable satellite There is also an electro-optical satellite under development that will fly in an SSO, have a five meter resolution, and is intended for tactical applications [79]

China is contracting with Italians for image processing computers and training for Chinese photo interpreters Another research effort is the development of a Synthetic Aperture Radar (SAR) satellite A SAR satellite would provide all weather and nighttime coverage that photographic and electro optical systems cannot provide [80] Finally, there is a program to develop data relay satellites that would enable data from electro-optical or SAR satellites to be down linked in real time rather than stored until the satellite comes into line of sight of a ground station.

There are two other significant research and development projects [81] The first is a UAV that would carry optical and infrared sensors, have a range of 150 km, and a maximum altitude of approximately 20,000 feet These would provide the PLA with real capability against indigenous or technically underdeveloped foes on their land borders. However, given its range and altitude, it has no survivability against sophisticated potential adversaries in the Pacific The second program is an Over-The-Horizon-Radar (OTHR) with a range of approximately 250 km In the 1970's an experimental OTHR was built Such a radar could be part of an architecture for employing long range anti-ship missiles By itself, the OTHR may provide some useful regional ocean surveillance capability However, it does not provide an over-the-horizon anti-ship targeting capability An overall architecture for that mission would need additional sensors with greater accuracy and target discrimination, command centers capable of highly sophisticated target tracking and weapons allocation, and jam resistant communications to the weapons system for redirection and target location updates [82]

The US Department of Defense (DoD) tracks worldwide trends in militarily critical technologies [83] They evaluate twenty-two nations' capabilities on each of the listed technologies and rate the nations' capability on a scale of one to four with one being the lowest rating Their rating of Chinese technology shows an interesting dichotomy In a set of ratings published in 1998, they evaluate 33 technology areas related to missile technology characterizing them as critical for supporting cruise, theater ballistic, or intercontinental ballistic missiles In 31 of those areas, China is given a rating of four and in the remaining two a rating of three However, in ratings published in 1996 they addressed a variety of technologies including C4ISR technologies Those ratings included twenty-eight technologies related to the discussion of RMA above in the general areas of information systems, space systems, electronics, signature control, and manufacturing In thirteen of these China was given a rating of one, in fourteen a rating of two, and only in one area did China merit a rating of three Intelligence community assessments have reached very similar conclusions regarding C4ISR related technologies [84]

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[1] In addition, the acronym C4ISR also refers to personnel, facilities, and procedures but these aspects are not addressed in this paper

[2] Welch "Some Perspectives on the Revolution in Military Affairs" points out that modeling and simulation technology - which is information technology but not C4ISR - is also an important part of the emerging RMA This aspect is not discussed in this chapter

[3] GWAPS
[4] Cited in Cohen, "A Revolution in Warfare" and Galdi, "Revolution in Military Affairs? Competing Concepts, Organizational Responses, Outstanding Issues" Fisher, "A Cold War Conundrum The 1983 War Scare" describes how these fears contributed to a perception that the US was preparing to attack the USSR
[5] Krepinevich, "Cavalry to Computer The Pattern of Military Revolutions" and Welch, "Some Perspectives on the Revolution in Military Affairs"
[6] Galdi, "Revolution in Military Affairs? Competing Concepts, Organizational Responses, Outstanding Issues"
[7] "Revolution in Military Affairs? Competing Concepts, Organizational Responses, Outstanding Issues"
[8] Jackson, "Global Attack and Precision Strike" in "Air and Space Power in the New Millennnium" Daniel Goure and Christopher M Szara eds
[9] Galdi, "Revolution in Military Affairs? Competing Concepts, Organizational Responses, Outstanding Issues"
[10] By contrast GWAPS (footnote #19 quoting the Strategic Bomber Survey) cites the statistics that in World War II the strategic bombing of Germany cost the US and British 150,000 personnel and 38,000 aircraft and resulted in the "incineration" of Hamburg, Dresden, and Tokyo
[11] Nye and Owens, "America's Information Edge"
[12] Nye and Owens, "America's Information Edge"
[13] Ginsberg, "Transformational Change and the Future of the Chinese Military" and Stokes, "China's Strategic Modernization Implications for US National Security" Willet, "East Asia's Changing Defense Industry" cites others who have made similar arguments pertaining not specifically to China but to the whole East Asia region
[14] Ginsberg, "Transformational Change and the Future of the Chinese Military"
[15] Nye and Owens, "America's Information Edge"
[16] The authors cited in notes 12 and 13 above are not specific on what subset of the RMA might constitute a "form" A point worth repeating is that an RMA is more than scattered ability to employ weapons more effectively There are however some possible "forms" that one could postulate In China's case, for example, it might focus on those capabilities for power projection to the islands of the West Pacific The point here is that even implementing just this "form" would require a sensor-to-shooter architecture with all the elements described in this section
[17] That conclusion by itself may only indicate Chinese intentions as reflected by their national resource allocation Although some Chinese military thinkers have called for emphasis on the RMA in military modernization, China may be no different from other nations in having a large gap between their visionaries and their resource allocators The importance of the second section looking at China's technology base is that even if China's true ["true" means reflecting financial commitments and not just statements of leaders] intention is to pursue military modernization through the RMA, their success depends on having an adequate technology base
[18] Cebrowski and Gartska, "Network Centric Warfare Its Origin and Future" present a visionary picture of how this would work The author has also benefited from attending their briefings and involvement in discussions on their work
[19] Cebrowski and Gartska, "Network Centric Warfare Its Origin and Future" They cite two examples of this The first is the deployment of carriers to the Taiwan Strait in 1995 in which the Seventh Fleet Commander's planning timelines were reduced from days to hours The second example is the Navy's Cooperative Engagement Capability (CEC) for fleet air defense
[20] JDW March 1998
[21] One of the technical aspects of these architectures is the need for archived imagery and mapping available as far forward as possible including cockpits of attack aircraft or even warheads of missiles To the extent this can be done, it reduces the capacity of the communications links needed to provide targeting updates This factor presents tradeoffs between storage technology and communications technology
[22] The US is developing Unpiloted Air Vehicles (UAV) that operate at high altitude and are capable of operating if the threat is short range air defense However, high altitude long range SAM's need to be suppressed or the attrition will be too high in most situations
[23] As this is being written, the fact that the US does not yet have this real time sensor-to-shooter capability is impacting the operations in Kosovo The Serbian mobile SAM's have evaded the initial strikes and

although operating without the benefit of centralized command and control, remain a danger to NATO Air Forces as that operation moves into its next phase The key reason why a real time architecture has not been implemented is the need for high capacity tactical data links The links are expensive to buy (The US Link-16 costs over $200,000 just for the radio) but the more important reason is the expense and technical difficulty of integrating it into the aircraft This integration requires complete rewiring of the aircraft and is therefore generally only done as part of a scheduled depot level overhaul In the case of the Chinese, they are building the SU-27's from kits and therefore do not have the capability for this level of overhaul

[24] United States Air Force (USAF) Fact Sheet 91-03

[25] The author is benefiting from discussions with Rand Corporation experts on this campaign

[26] The emerging global fiber optic grid may (in combination with other assets) take some of this load in the future but cannot replace satellites even for unprotected high capacity requirements

[27] The approximate numbers are 150 Mbps for the Persian Gulf and 470 Mbps for the Bosnian operation These numbers are based on data from the Joint Staff Mbps stands for "Mega bit per second" A rough rule of thumb often used to put this in perspective is that one Mbps will transmit a novel the size of Moby Dick in about two minutes One Mbps will also provide live full motion studio quality video The communications capacity for both of these operations was very large by any standards and as the RMA matures, the need for capacity is expected to continue to grow exponentially

[28] National Imagery Interpretability Rating Scales (NIIRS) are described in FAS Intelligence Resource Program

[29] FAS

[30] Quoted in Willet, "East Asia's Changing Defense Industry" who is paraphrasing others rather than advancing the argument herself

[31] "The Revolution in Military Affairs and Asian Security"

[32] In some cases this may change soon enough to be relevant to this assessment, which is focusing on the next ten to twenty years For example, despite US Government efforts to stop it, it is quite possible that hard cryptological capability will become available on the global market

[33] Or in some cases, for which commercial customers would like to have but are not willing to pay in either dollars or in degraded performance

[34] This may be a case where there would be a demand if it were not so difficult and expensive See the discussion in note 22 above

[35] The B-2 was used briefly in Kosovo

[36] See e g JDW April 1996

[37] As this is written, there has been a loss of one F-117 in Serbia for reasons that are not known or at least not published

[38] JDW April 1997

[39] JDW December 1997

[40] JDW April 1997

[41] JDW April 1996 and June 1997 Missions include SEAD, deep interdiction, and battle damage assessment in high-risk areas

[42] Ginsberg, "Transformational Change and the Future of the Chinese Military"

[43] JDW July 1996

[44] JDW November 1997

[45] JSWS

[46] JIR November 1993

[47] JSWS, JIR August 1992 and October 1992

[48] The US also has warning satellites in GEO There is no evidence that China has or is developing a warning satellite Recently US commercial companies (Iridium and Teledesic being two better known examples) have developed communications satellites in LEO This represents a substantial jump in technology and is regarded as a moderate to high technical risk undertaking even for leading edge US companies

[49] The author was part of a space policy study during the 1980's that among many other issues looked into the military significance of men in space The only military benefits identified were possible future on orbit repair or construction The Chinese are decades away from having a military space program where such capabilities would be useful

[50] The journalist Chou Kuan-Wu states that "China mastered the technology of independently sending man into space some 20 years ago [but] planned to wait until the year 2000 before send[ing] the first Chinese astronaut into space" FBIS 03/16/98

[51] The US offer was made during President Reagan's visit to China in 1984 The loss of the Challenger in 1986 occurred before a Chinese astronaut could come to the US for training and the matter was dropped The Russian offer was made by Gorbachev in 1986 and it is not known how far it was pursued JIR April 1997

[52] JIR April 1997

[53] FBIS 03/16/98

[54] JIR November 1993

[55] FBIS op cit

[56] Stokes, "China's Strategic Modernization Implications for US National Security"

[57] FBIS op cit, Defense Week, 02/08/99

[58] FBIS 12/07/97

[59] This paragraph is based on material in Ball, "Signals Intelligence in China"

[60] Stokes, "China's Strategic Modernization Implications for US National Security"

[61] Electronic Business, Sept 1998

[62] Wash Post March 5, 1999

[63] Janes Spacecraft, 1998/1999

[64] Janes Spacecraft, 1998/1999

[65] Janes Spacecraft, 1998/1999

[66] Defense Week, February 8,1999

[67] Communications Today, February 11, 1999

[68] Humphrey, "Managing the Software Procss" contains one of best explanations of this That book describes the results of a program at the Carnegie Mellon Software Engineering Institute (SEI) that responded to a perceived "national emergency" in software Even though the US was by far the world's leader in leading edge software (most software subcontracted overseas is built to detailed specifications that are developed in the US), the cost is escalating at rates that could endanger continued progress The SEI program defined five levels of capability in software development, measurable criteria for reaching each level, and an audit process for evaluating software developers It takes years and a substantial investment in time, money, training, and management commitment to move up each level As of 1993, when the author researched this topic, fewer than ten software development centers in the entire US had certifiably reached the top level By contrast, over 80% of US software developers in both the public and private sectors rated at the lowest level Software development is still mostly a "cottage industry" depending for its success on the skill, knowledge, and experience of individual engineers and programmers

[69] Popular Science 1996

[70] Dibb, "The Revolution in Military Affairs and Asian Security" makes the point that all of the Asia-Pacific nations, except the US, have weaknesses in this area Japan and Singapore have specifically designated it as an educational priority The author has heard top executives from US industry both publicly and privately express the view that by traditional management metrics, large-scale systems integration is a weakness for everyone

[71] Frankenstein and Gill, "Current and Future Challenges Facing Chinese Defense Industries"

[72] Frankenstein and Gill, "Current and Future Challenges Facing Chinese Defense Industries"

[73] Frankenstein and Gill, "Current and Future Challenges Facing Chinese Defense Industries" and Gurtov and Hwang, "China's Security The New roles of the Military"

[74] Gurtov and Hwang, "China's Security The New roles of the Military" has descriptions of two successful case studies

[75] Frankenstein and Gill, "Current and Future Challenges Facing Chinese Defense Industries"

[76] Stokes, "China's Strategic Modernization Implications for US National Security"

[77] The US has the strategic option of aiding its allies and in fact does not need to be completely self-sufficient at the low end

[78] A good source is the article "Commercial Imagery" in Airpower, the on line magazine of Air University

[79] Stokes, "China's Strategic Modernization Implications for US National Security"

[80] Stokes "China's Strategic Modernization Implications for US National Security" According to the Chinese sources quoted by Stokes, the SAR, including an airborne SAR appear to be for mapping and

natural disaster warning and control Pending the indigenous development, China is buying SAR imagery from Canada Stokes states that SAR imagery is "extremely useful in tracking moving objects" This statement is certainly exaggerated if it is intended to imply a tactical application of tracking an object on a battlefield After a slow and difficult imagery interpretation by a specialist in SAR imagery (or the future development of an automated change detection capability that even the US considers a far term possibility at best), it is possible to detect that objects have moved from one pass of the satellite to the following pass Since the separate passes may be hours apart, this is not tactical tracking

[81] Stokes, "China's Strategic Modernization Implications for US National Security"

[82] The author was part of a study of this issue many years ago It is very difficult to target a moving vessel that is beyond the range of organic sensors A historical note is that although the Tomahawk was originally proposed as an anti-ship missile, it is being used as a land attack missile primarily because of these difficulties It is for this reason that even if the Chinese develop a land based missile capable of striking say, a US naval task force east of Taiwan, those missiles would constitute at most a minor threat to the task force This reasoning applies only if the missiles are assumed to be armed with conventional rather than nuclear warheads

[83] Published in a series of documents "Military Critical Technologies List" (MCTL)

Chapter V **Summary and Conclusions**

Summary

This chapter is a short summary of the report The report addressed the prospects that the PLA could develop a military capability within the next ten-twenty years that could challenge the US or its allies It focused only on conventional forces and specifically addressed the impact on future PLA prospects of the RMA

Chapter III, which is based on a review of the literature on the subject, is a traditional assessment of the PLA modernization The conclusion is that the PLA is selectively improving its capability but not at a rate that will significantly alter the Asia-Pacific regional balance of power. This improved capability is almost certainly making the PLA a more formidable force compared to the nations sharing a land border with China and against potential insurgents within China However, the PLA is not acquiring within the assessment time frame sufficient power projection capability to threaten (with conventional forces) its more sophisticated neighbors in the Pacific

Chapter IV looked at the RMA. It first described the concept of the RMA and what it takes to implement the RMA in any militarily significant way. Then the chapter assessed whether the RMA provides China with an opportunity to accelerate its military modernization The conclusion of Chapter IV that the RMA is not an opportunity for China but is actually more of a barrier China's current programs in Space and C4ISR are two to three generations behind what could enable an RMA Furthermore, assessments of China's technology base as well as many problems with their military industrial base make it unlikely China can catch up within the assessment time frame

In applying these results, it is useful to state explicitly the full set of assumptions that need to be made in order to support the conclusion that China could become a military threat to the US and its allies and then review what this report concludes about each of them For China to develop a military capability that would alter the strategic balance of power compared to the US and its allies in the Asia-Pacific region, all of the following need to happen

1 China remains stable under its current government or a successor that takes power in a non-violent fashion
2 Economic reforms continue and China maintains high growth rates
3 Chinese military expenditures grow in real terms and China continues to invest in modernization including in particular, its Rapid Reaction Forces (RRF), PLA Navy (PLAN), and PLA Air Force (PLAAF)
4 The Chinese Military Industrial Complex (CMIC) successfully completes their current aircraft, ship, submarine, missile, and C4ISR acquisitions Within this assumption is that they learn to develop and efficiently operate a defense industrial base capable of building and supporting these systems

5 The PLA successfully makes the organizational culture change required to become a professional military force
6 The Chinese successfully implement and operate modern integrated logistics, training, and support systems.

Although some of the references address the CCP's ability to maintain control of a unified China, independent analysis of the first assumption is outside the scope of this report In essence, the continued stability of China is assumed for purpose in this report.

The economic assessment in Chapter II addressed the second assumption. It concluded that the combination of needing to absorb the unprofitable State Owned Enterprises (SOE), a banking system with a huge overhang of non-performing loans, and the effects of the Asian economic crisis make it unlikely that China can continue its growth rates of the past two decades.

Assumption three is related to assumption two but more demanding The analysis of defense spending in Chapter III indicates that despite the economic growth of the past two decades, real defense spending -- that is after inflation -- has either been flat or has at most expanded slowly The assessment of PLA modernization concluded that the current program even if successfully continued is not sufficient to alter significantly the regional balance of power To implement a modernization program that would alter the balance of power, there needs to be significant real (i e after inflation) growth in spending Significant real growth in defense spending would require some combination of even faster economic growth and the willingness and ability of the CCP to reprioritize in favor of military spending

Assumption four is that if China finds and allocates sufficient funds for modernization, the CMIC will successfully execute the programs The discussion of the CMIC in Chapter IV pointed out that the track record of successful program execution is not good and describes the difficulties that cloud its prospects In order for defense industries to survive economically they are switching most of their production to civilian goods to be sold in commercial markets Chapter IV described the difficulty many firms are having making the culture change to become efficient operations able to compete commercially Their inability to accomplish this puts many of them in a financial situation that is precarious for their mere survival and consequently endangers the success of their military programs Finally, the CMIC needs to get over the effects of the Third Front which placed many key industries away from both supporting infrastructure and from other economic activity that could cushion adjustments to the labor force and thus provide some flexibility

Based on the discussion of personnel and military education in Chapter III, assumption five on professionalization appears to be taking time but getting there One aspect of professionalization is the need to get the PLA out of non-defense related business in order to eliminate distractions and some forms of corruption However, since these businesses

provided needed funds for the PLA which the government needs to make up, their elimination casts further doubt on assumption three

Assumption six addresses the ability of the PLA to operate and maintain modern military equipment when the CMIC is able to deliver it This requires first of all substantial investment in modernization of the PLA support and training infrastructure It also requires an organizational culture change in the logistics, training, and support commands and agencies that is at least as difficult as those assumption four makes regarding CMIC As indicated frequently throughout this report, the Chinese track record is poor and there is little indication that it is being addressed as a priority

Conclusion

The preface to this report stated that it is intended to inform the debate on whether China poses a future strategic threat in the Asia-Pacific region. A complete discussion of the "China threat" debate would consider intentions as well as all aspects of military, economic, technological, diplomatic, and cultural capability. With the world's largest population, third largest economy, a permanent seat on the UN Security Council, and many other assets China is certainly already a major regional power. In most if not all of these dimensions of national power, China seems likely to continue to grow in regional importance. That prospect combined with differences between the US and China on some regional issues causes the concern behind the "China threat" thesis The fear is that China could grow into a regional peer competitor who is hostile to the US and its allies As indicated in the first chapter and the references cited there, this is a dubious thesis However, as some of those references indicate, there are elements within China who would be actively hostile to the US and its allies and it is an important question what might happen if they became predominant within China The "China threat" debate thus breaks into two questions The first is the likelihood of a hostile leadership coming to power in China The second question is whether that leadership could build China into a peer competitor This second question can be posed as the larger question of whether the state behaviors required to build a modern economy (needed to become a peer competitor) in today's open global marketplace that is driven by the advanced knowledge and skills of workers who enjoy global mobility is consistent with the behaviors of a hostile and aggressive state

This report can be considered a case study of the second question It focuses specifically on military capability, which is perhaps the most important dimension of state power The report concludes that in terms of conventional military capability China is unlikely to become a military peer competitor to the US and its allies in the next ten-twenty years Of the six assumptions required for China to achieve that status, only the first and fifth seem likely in the near future This is not to say that a US-China military confrontation will not occur Even with the current leadership there are flash points in Taiwan and possibly in North Korea and the South China Sea Furthermore, in a military confrontation China could achieve its political objectives if there is an asymmetry in risk aversion or in willingness to take casualties This report's conclusion does however imply that such an asymmetry would be needed The report's conclusion also implies that

a return to a bipolar superpower competition, or a regional power transition, is further than twenty years into the future

List of Acronyms

AAW	Anti-Air Warfare
AEW	Airborne Early Warning
CCP	Chinese Communist Party
CIA	Central Intelligence Agency (US)
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CMIC	China's Military Industrial Complex
COSTIND	Commission on Science, Technology, and Industry for National Defense
CZ	Chang Zheng (launch vehicles)
DFH	Dong Fang Hong (Satellite)
DoD	Department of Defense (US)
DSCS	Defense Satellite Communications System (US military communications satellite)
FSW	Fanhui Shi Weixing (satellite)
FY	Feng Yun (satellite)
GA	Group Army
GDP	Gross Domestic Product
GEO	Geosynchonous Orbit
GLD	General Logistics Department
GMSIS	Global Mobile Satellite Informaion System
GWAPS	Gulf War Air Power Survey
IAI	Israeli Aircraft Industries
IC	Integrated Circuit
ISARC	Intelligence, Surveillance, and Reconnaissance Cell
IMINT	Imagery Intelligence
JASSM	Joint Air-to-Surface Standoff Missile
JSOW	Joint Standoff Weapon
LEO	Low Earth Orbit
MCTL	Military Critical Technologies List
MID	Militarized Interstate Dispute
MR	Military Region
NATO	North Atlantic Treaty Organization
OTHR	Over-the-Horizon Radar
PAP	People's Armed Police
PGM	Precision Guided Munition
PLA	People's Liberation Army
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy

PPP	Purchasing Power Parity
PRC	People's Republic of China
RDF	Rapid Deployment Force
RITA	Rapid Imagery Transmission to Aircraft
RMA	Revolution in Military Affairs
RRF	Rapid Reaction Force
RTS	Rapid Targeting System
SAM	Surface-to-Air Missile
SAR	Synthetic Aperture Radar
SEAD	Supression of Enemy Air Defense
SIGINT	Signals Intelligence
SLOC	Sea Lines of Communication
SOC	Sector Operation Center
SOE	State Owned Enterprise
SS	Conventionally power attack submarine
SSBN	Ballistic Missile Submarine
SSM	Surface-to-Surface Missile
SSN	Nuclear powered attack submarine
SSO	Sun Synchronous Orbit
TT&C	Telemetry Tracking and Control
UAV	Unpiloted Air Vehicle
UCAV	Unpiloted Combat Air Vehicle
US	United States
USSR	Soviet Union
WWII	World War II

References

The following sources are frequently cited by acronym

ADJ - Asian Defense Journal
APDR - Asia Pacific Defense Reporter
ASWT - Aviation Week and Space Technology
FAS - Federation of American Scientists [www fas org]
FBIS - Foreign Broadcast Information Service
FEER - Far Eastern Economic Review
GWAPS - Gulf War Air Power Survey
IISS - International Institute of Strategic Studies, (annual strategic surveys)
JIR - Janes Intelligence Review
JDW - Janes Defense Week
JSWS - Janes Strategic Weapons Systems
NYT - New York Times
WP - Washington Post

Allen, Kenneth, Krumel, Glenn, and Pollack, Jonathan D , "China's Air Force Enters the 21st Century", Rand, Santa Monica, 1995

Ball, Desmond, "Signals Intelligence in China", Janes Intelligence Review, Volume 7 Number 8, London, August, 1995

Bernstein, Richard, and Munro, Ross H , "The Coming Conflict with America", Foreign Affairs, New York, March/April, 1997

Bickford, Thomas J , "The Chinese Military and its Business Operations", Asia Survey, May, 1994

Bitzinger, Richard A , and Gill, Bates, " Gearing Up for High Tech Warfare? Modernization and Implications for Military Confrontation Across the Taiwan Strait, 1995-2005", Center for Strategic and Budgetary Assessments, Feb 1996

Calder, Kent, "Asia's Deadly Triangle", Nicholas Brealey, London, 1997

Cebrowski, Vadm(ret) Arthur K , and Gartska, John J , "Network Centric Warfare Its Origin and Future", Naval Institute Proceedings, January 1998

Cohen, Eliot A , "A Revolution in Warfare", Foreign Affairs, March/April, 1996

Cronin, Audrey Kurth, and Cronin, Patrick M , "The Realistic Engagement of China", The Washington Quarterly, Winter, 1996

Denny, Roy, "The 'China Threat' Issue: Major Arguments", Asian Survey, Berkeley, August, 1996

Dibb, Paul, "The Revolution in Military Affairs and Asian Security", Survival, London, Winter 1997/1998

Dreyer, June Teufel, "The New Officer Corps Implications for the Future", The China Quarterly, London, June 1996

Fischer, Ben B , "A Cold War Conundrum: The 1983 War Scare", Center for the Study of Intelligence, Washington, September 1997

Frankenstein, John, and Gill, Bates, "Current and Future Challenges Facing Chinese Defense Industries", China Quarterly, London, June,1996

Frolov, Viacheslav A, "The PLA's Naval Buildup in the 1990's. A Political as Much as a Military Message", Defense and Foreign Affairs Strategic Policy, Alexandria, Aug, 1998

Fung, K.C , and Lau, Lawrence J , "China's Foreign Economic Relations", Asia Pacific Research Center, May, 1997

Galdi, Theodor W , "Revolution in Military Affairs? Competing Concepts, Organizational Responses, Outstanding Issues" Congressional research Service, Washington DC, December 1995

Ginsberg, Daniel, "Transformational Change and the Future of the Chinese Military", SAIS Review, Johns Hopkins Univ ,1998

Godwin, Paul H B , "From Continent to Periphery: PLA Doctrine, Strategy, and Capabilities towards 2000", The China Quarterly, June 1996

Gurtov, Mel, and Hwang, Byong-Moo, "China's Security The New roles of the Military", Lynne Rienner, Boulder, 1998

Hornik, Richard, "Bursting China's Bubble - The Muddle Kingdom?", Foreign Affairs, May/June 1994

Hughes, Niel C , "Smashing the Iron Rice Bowl", Foreign Affairs, July/August 1998

Humphrey, Watts S , "Managing the Software Process", Software Engineering Institute Series in Software Engineering, Addison-Wesley, New York,1989

Jackson, Jeffry A , "Global Attack and Precision Strike" in "Air and Space Power in the New Millennnium" Daniel Goure and Christopher M Szara eds , Center for Strategic and International Studies (CSIS), Washington DC

Johnston, Alastair Iain, "China's Militarized Interstate Dispute Behavior 1949-1992 A First Cut at the Data", The China Quarterly, London, March,1998

Kim, Samuel S , "China's Quest for Security in the Post Cold War", Strategic Studies Institute, 1996

Krepinevich, Andrew F., "Cavalry to Computer The Pattern of Military Revolutions" The National Interest, Fall 1994

Kristof, Nicholas D , and Wudunn, Sheryl L , "China Wakes The Struggle for the Soul of a Rising Power", Vintage Books, New York, 1994

Krugman, Paul, "The Myth of Asia's Miracle", Foreign Affairs, New York, Nov/Dec 1994

Krugman, Paul, "Saving Asia. It's Time to Get Radical", Fortune, New York, Sept 7, 1998

Lampton, David M , "China", Foreign Policy, Washington, Spring, 1998

Lardy, Nicholas R. "China in the World Economy", Institute for International Economics, Wash DC, 1994

Lardy, Nicholas R , "China and the Asia Contagion", Foreign Affairs, July/August 1998

Li, Nan, " The PLA's Evolving Warfighting Doctrine, Strategy, and Tactics, 1985-1995. A Chinese Perspective", The China Quarterly, London, June 1996

Mao Tse-Tung, " Guerrilla Warfare and Marxism", 1937

Mao Tse Tung, "On Protracted War", May,1938

Mao Tse-Tung, " Problems of Strategy in Guerrilla War Against Japan", May, 1938

Mao Tse-Tung, "Problems of War and Strategy", November, 1938

Mao Tse-Tung, "Concentrate a Superior Force to Destroy the Enemy Forces One By One", September 1946

Nye, Joseph S , "China's Reemergence and the Future of the Asia Pacific", Survival, London, Winter, 1997/1998`

Nye, Joseph S and Owens, William A , "America's Information Edge" Foreign Affairs, March-April 1996

Perry, William J , "Asian Pacific Security in the Post-Deng Era", Asia Pacific Research Center, November, 1997

Popular Science Special Issue on China's Science and Technology New York, August, 1996

Rachman, Gideon, "Containing China" The Washington Quarterly, Winter, 1996

Rohwer, Jim, "China The Real Economic Wild Card", Fortune, New York, September 28,1998

Ross, Robert S., "Beijing as a Conservative Power", Foreign Affairs, March/April 1997

Segal, Gerald, "China's Changing Shape", Foreigh Affairs, New York, May/June 1994

Shambaugh, David, "China's Military. Real or Paper Tiger?" The Washington Quarterly, Washington, Spring,1996

Shambaugh, David, "China's Military in Transition Politics, Professionalism, Procurement, and Power Projection", The China Quarterly, London, June 1996

Shambaugh, David, "China's Post - Deng Leadership New Faces, New Trends", Asia Pacific Research Center, June,1998

Shichor, Yitzhak, "Demobilization The Dialectics of PLA Troop Reduction", The China Quarterly, London, June, 1996

Shy, John, and Collier, Thomas W , "Revolutionary War", in "Makers of Modern Strategy from Machiavelli to he Nuclear Age", Peter Paret ed , Princeton University Press, Princeton, NJ, 1986

Starr, John Bryan, "Understanding China", Hill and Wang, New York, 1997

Stokes, Mark A , "China's Strategic Modernization Implications for US National Security" USAF Institute for National Security Studies, October, 1997

Wang, Shaoguang, "Estimating China's Defense Expenditure· Some Evidence from Chinese Sources", The China Quarterly, London, September, 1996

Welch, Thomas J , "Some Perspectives on the Revolution in Military Affairs", Office of Net Assessmant, Office of the Secretary of Defense

Willet, Susan, "East Asia's Changing Defense Industry", Survival, London, Autumn, 1997

Yergin, Daniel, Eklof, Dennis, and Edwards, Jefferson, "Fueling Asia's Recovery", Foreign Affairs, New York, March/April, 1998